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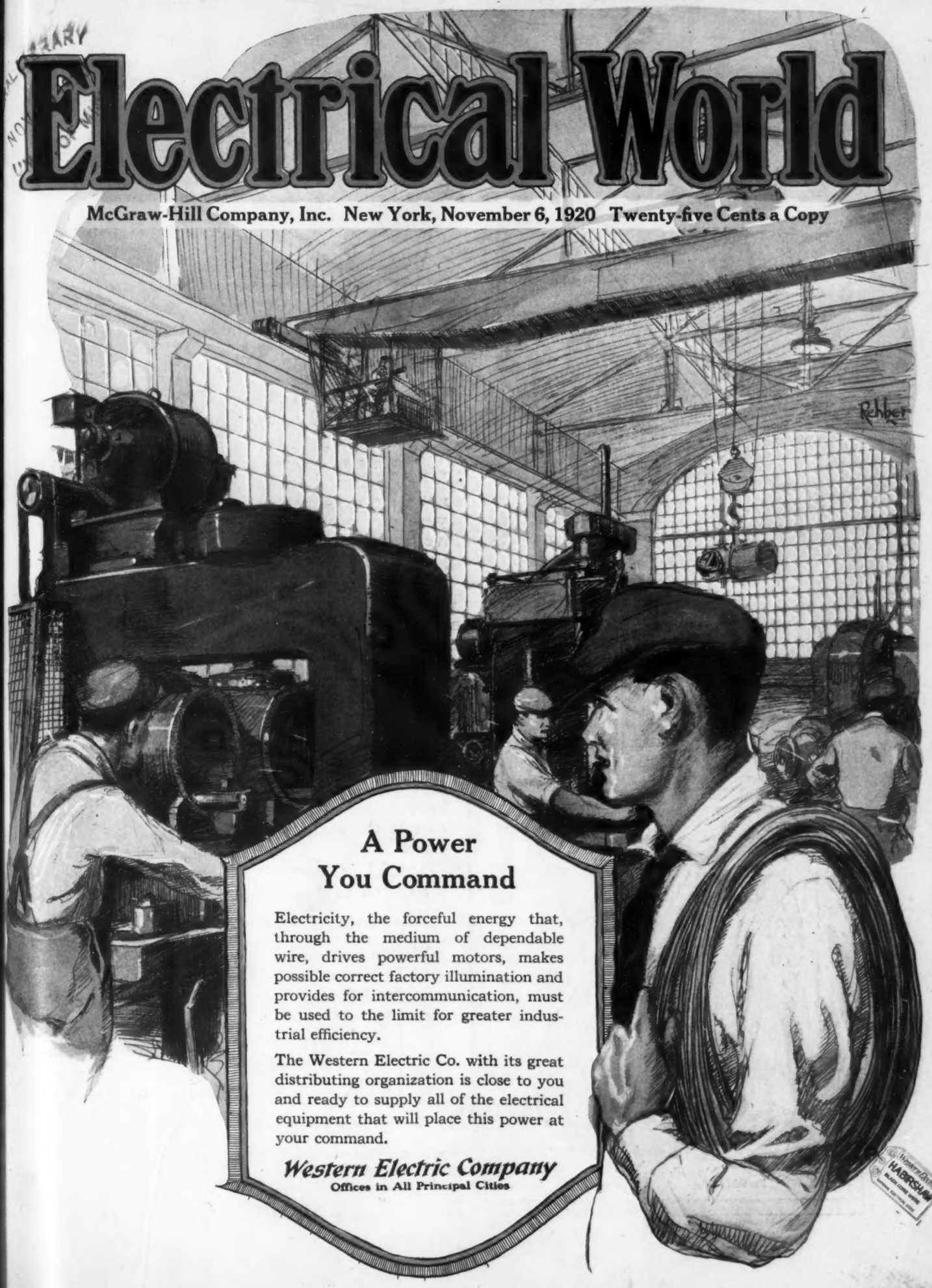

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Electrical World

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Power Contracts and the Small Consumer

THE Public Utility Commission of Utah in its decision on the special contracts of the Utah Power & Light Company has established a precedent of great moment to electric light and power companies. In brief, the case dealt with contracts, mostly for long terms, which were not in conformity with published schedules of the power company, but were preferential and discriminatory. Without setting aside the contracts—in fact, holding that they are still binding on the consumer—the Utah commission held that in the interests of the general public it can modify and change them in so far as they relate to rates, facilities and privileges. This is of special significance to the small consumer, for if large power consumers because of legal change of rate can break contracts and supply their electrical wants from isolated plants, for instance, the large central-station investment made to serve them would be lost, and hence the interest on that investment would have to be borne by all other users. This is the chief point in the Utah Power & Light case.

Training Men for Some One Else

CENTRAL-STATION maintenance work has of necessity been very largely neglected during the last few years. While in most departments this has been often due to lack of materials, in the meter department the lack of suitably trained men has been and still is the principal difficulty. Meters have been rightfully termed the cash registers of the industry, and upon their proper maintenance may depend whether a company will show a loss or a profit on its operations. Meter maintenance requires the services of technically trained men, and the work has proved attractive to the younger men entering the industry. However, the remuneration has too often been insufficient to induce those having the proper qualifications to stay at it long enough to be able to do the advanced work. The money which might have been used to increase salaries is now being used continually by some utilities to train new men who soon leave to get more money and often better working conditions from companies which have spent nothing on training. Universities in the Middle West have performed a real service by conducting metermen's courses to increase efficiency. However, better qualified employees want more pay, and therefore this education may increase rather than decrease the difficulty of retaining good metermen. The revenue of a central station depends so much on efficient meter maintenance and testing that this work should be made amply remunerative and probable avenues of advancement should be opened up. New men should be trained, but the educational system should not be allowed to become so burdensome that the companies cannot make meter maintenance attractive enough to hold the men for advanced work after they have become proficient.

Exporting Electrical Goods to China

THE organization of a hundred-million-dollar export financial corporation by the American Bankers' Association to further national welfare by maintaining and effectively developing American foreign trade ought to set at rest any fear that American industry will be swamped by European goods dumped on the market. It ought also to give heart to American manufacturers contemplating export trade. Only a short while ago a consortium of American, English, French and Japanese bankers was arranged for financing and furthering Mongolian trade. Commenting on this arrangement, Mr. Lamont of the banking house of J. P. Morgan indicated that China, in addition to requiring a great system of railways, would need a large quantity of electrical equipment. He indicated that 400,000,000 of kindly, honest and highly intelligent people would require on a prodigious scale the many domestic appurtenances that American ingenuity has evolved and that to keep these millions supplied with motion pictures alone would be quite a task even for Americans. Discounting his statement by 75 per cent, the fact remains that the opportunities are still immense. If China is to receive financial assistance from the United States, she will of necessity use American goods, and among the numerous branches of industry in which America excels the electrical is not the least. American manufacturers of electrical goods should therefore look to the Far East for new business of some importance.

Plant Efficiency Rewards Hard Work

POOR coal, irregular fuel supply, changing loads, labor difficulties and inexperience in co-ordinating plants for maximum combined operating efficiency put a heavy burden upon the central-station manager in many localities. It is not so easy under these conditions to produce energy at figures which may be cited with pride. None the less, the present high cost of production justifies a more vigorous attack upon station fuel losses than has been conducted in some places since the close of the war. That such an attack may be successful is clear from a recent comparison of two successive years' operations in about half a dozen plants ranging in size from 11,000 kva. to 63,000 kva. Two years ago the yearly records showed that five out of seven of these plants consumed above 2.3 lb. (1 kg.) of

coal per kilowatt-hour, the best showing being about 1.93 lb. (0.87 kg.). In the fiscal year just closed half the plants ran below 2.3 lb., and the best showing was 1.74 lb. (0.78 kg.). All the plants were within a radius of 150 miles (240 km.). Industrial power plants in the same region often consume 4 lb. or 5 lb. (1.8 kg. or 2.2 kg.), and it is gratifying to see these medium-sized central stations responding to hard and sustained work on the part of their operating managements. The central station points the course of efficiency for all power producers, and every manager should devote his best efforts to the arduous task of getting the most possible out of his equipment.

The Power Situation on the Pacific Coast

ONE of the singular features of electric power development is that in the three Pacific Coast states, which have been a most progressive part of the country in transmission work and which have more than 40 per cent of the available water power of the United States, there should still be serious shortage of water power—one which called for the consumption of nearly 5,000,000 barrels of fuel oil last year. The situation really points directly to the weak spot in all hydro-electric development, that is, the great variability from season to season and year to year in water supply. A paper by F. H. Fowler in last week's issue brings the salient points of the situation into view in the most striking manner. The fundamental fact is that the rainfall along the Coast decreases steadily from north to south, some parts of Washington showing the highest annual rainfall in the United States, while portions of southern California drop to near the minimum. The northern portion of the range is well forested, the southern portion is bare, which again has its effect on the annual distribution of run-off.

The use of power varies seasonally, like its source, and to make the most of the total resources one must have the maximum practicable storage. Here again the possibilities vary widely along the Pacific coast. In the extreme north the available heads are comparatively moderate, and for this as well as other topographical reasons storage on a large scale is somewhat difficult. As one goes southward opportunities for storage with high heads present themselves, but the water supply is extremely variable from month to month. In the northern region, as Mr. Fowler shows, there are great possibilities in the way of developing cheap power on a large scale, power cheap enough to be utilized for electrochemical or similar industries were the conditions favorable.

Some of these industries are of a character that to a certain extent makes it possible to develop them with regard to seasons, and therefore if cheap power were available from surplus water power for four or five months in the year good use could be made of it. Then, too, in many regions the amount of usable power varies with the irrigation situation, itself demanding storage. The maximum utilization therefore depends on combining these contributing factors into a connected whole so that surplus water shall be stored as far as possible, preferably in places where the need for irrigation or the available head is very great. Granted storage, it is still necessary so to distribute and operate the sources of power on the great network of distribution as to enable this storage to be carried out at the best efficiency, that is, when and where the loss of potential energy, measured in cost, is a minimum. This is the crux of the whole hydro-electric problem. The situation affords certainly the best opportunity for utilizing a great trunk-line distribution that has yet developed, and, further, it is not complicated by the presence of either cheap coal or cheap transportation.

Illumination for the Average Eye

FROM a practical standpoint perhaps the most noteworthy paper presented at the recent Illuminating Engineering Society convention was that by Dr. C. E. Ferree and G. Rand on the functioning of the working eye under variations of illumination. The knowledge heretofore available pertained to vision of test objects under uniform conditions of illumination in a fixed place, while the great value of Ferree and Rand's most recent work is that they have studied conditions of vision somewhat as they would be found in actual industrial operations. The result of their research is to place before the illuminating engineer a most important mass of new data of direct practical bearing in his work.

The investigators started out by a carefully conducted series of acuity tests showing the power of discrimination of the eye for detail at various illuminations. The variation of acuity thus found does not differ widely, when the nature of the test object is taken into account, from variations obtained by other investigators, but it shows a somewhat more rapid rise of acuity with illumination above two or three foot-candles in intensity. Following the same process with acuity measurements made by means of lenses giving slight astigmatism, it was found that the gain in acuity with increasing illumination was considerably more marked than in the normal eye. In other words, for the common, somewhat imperfect eye, high illumination is even more necessary than with perfect vision.

In the investigation of the readiness with which detail could be quickly grasped under varying illumination, where the speed of seeing is taken into account, a still greater improvement appeared as illumination increased. The same kind of improvement was shown when the test made had to do with the prompt shifting of the eye from plane to plane, often necessary in industrial work, and finally when the power of the eye to sustain high acuity for considerable periods was tested the importance of good lighting came out with astonishing force.

These investigations throw a new light on the value of high degrees of illumination under conditions of practical working. As a striking and yet not extreme example of results found, passing from two to six foot-candles slightly more than doubled the acuity, changed the speed of discrimination and the speed of adjustment in nearly the same ratio, and increased the power to sustain acute vision more than fivefold. For a slightly astigmatic eye the general results were similar, except that the speed with which detail was picked up under the higher illumination was increased thirteen times. The evidence is most conclusive as to the need of considerably higher illumination than has heretofore been considered necessary, when one takes into account the average rather than the perfect eye and the conditions of quick and easy seeing over the working day which form the basis of industrial efficiency.

Co-ordinated Inspection Forestalls Operating Trouble

IN THE earlier days of electrical distribution inspection consisted chiefly in waiting for something to happen and hoping nothing would. Today every operator of a power system realizes that the best way to prevent things from happening is to keep on the constant look-out for sources of danger and to do away with them promptly before they cause trouble. A good case in point is that which we describe this week as a fair type of the inspection systems found practically useful in operating power transmission systems.

It will be observed from the tables which accompany the article that the whole scheme is based on doing regularly what is too frequently left to some convenient time. First comes very frequent examination of everything which from constant use and the nature of its service is likely to make trouble on short notice; second, a rather frequent study of material less likely to deteriorate through use or less used is made, and finally, at regular times, a very careful overhauling of fundamental apparatus takes place to detect incipient faults which may have been overlooked in general operation or in more casual inspection.

The records of the company referred to show that this systematic way of following up all the equipment from day to day or week to week is really worth while, because it means continuity of service, fewer minor repairs, and sometimes avoidance of serious major repairs. Nothing except co-ordinated inspection of this kind can really accomplish the result sought, since it is extremely easy for casual inspection at odd times to miss parts of the equipment or to overlook the numerous small things which may cause material damage or even shut down the station.

Axe and Good Insulators Best Safeguards of Lines

ETERNAL vigilance is the price of continuity of service. This fundamental is peculiarly true of the sort of system which F. I. Bowler considers in this issue; that is, a comparatively small system formed by the interconnection of previously independent stations with lines built for various voltages and at various times. Transmission systems of this general character are particularly likely to show the results of heterogeneous methods of building in a somewhat unpleasant manner. The value of Mr. Bowler's article lies in the fact that it deals with successful efforts to improve the service with regard to interruptions during a program that has extended over about ten years. The system started off with something like five interruptions per mile of line per year, and it has wound up the period with less than one. Analyzing the situation, improvement in the last three or four years has been very marked and appears to be due purely to care of the lines themselves, watchfulness in maintenance and the abandonment of dubious construction as soon as it is detected.

The final result speaks well for the performance of wood-pole lines for moderate voltages when the construction is carefully watched. A modest amount of tower line insulated for double the present working voltage has very naturally shown exceedingly little trouble of any kind. On the wood-pole lines constructions which were obviously bad, like pole-top insulators grounded on the lightning protection and pin-type insulators with the axis horizontal, were cut out with good results. The burden of the whole story is that when a group of plants of varying age and character are interconnected the strength of the outfit is simply that of the weakest point, as usual, and concurrently with any such interconnection must come a general and thorough overhauling of the system. The sooner this is done the better. The weak point of most of the older constructions was an insufficient factor of safety in the insulation, with resulting serious dangers from overvoltage, whether from surges or induced lightning discharges. This situation is rendered worse by not infrequent carelessness with regard to proximity of trees found along moderate-voltage lines of small companies.

In the particular instance before us the extent to which trees were looked out for is shown by the practical cessation of troubles from this cause after the first two or three years of consolidated operation. Nothing but constant watchfulness can avoid interruptions on moderate-voltage circuits of old design running through a wooded country. The axe and good insulators are the best preventive methods whatever the material of the pole line.

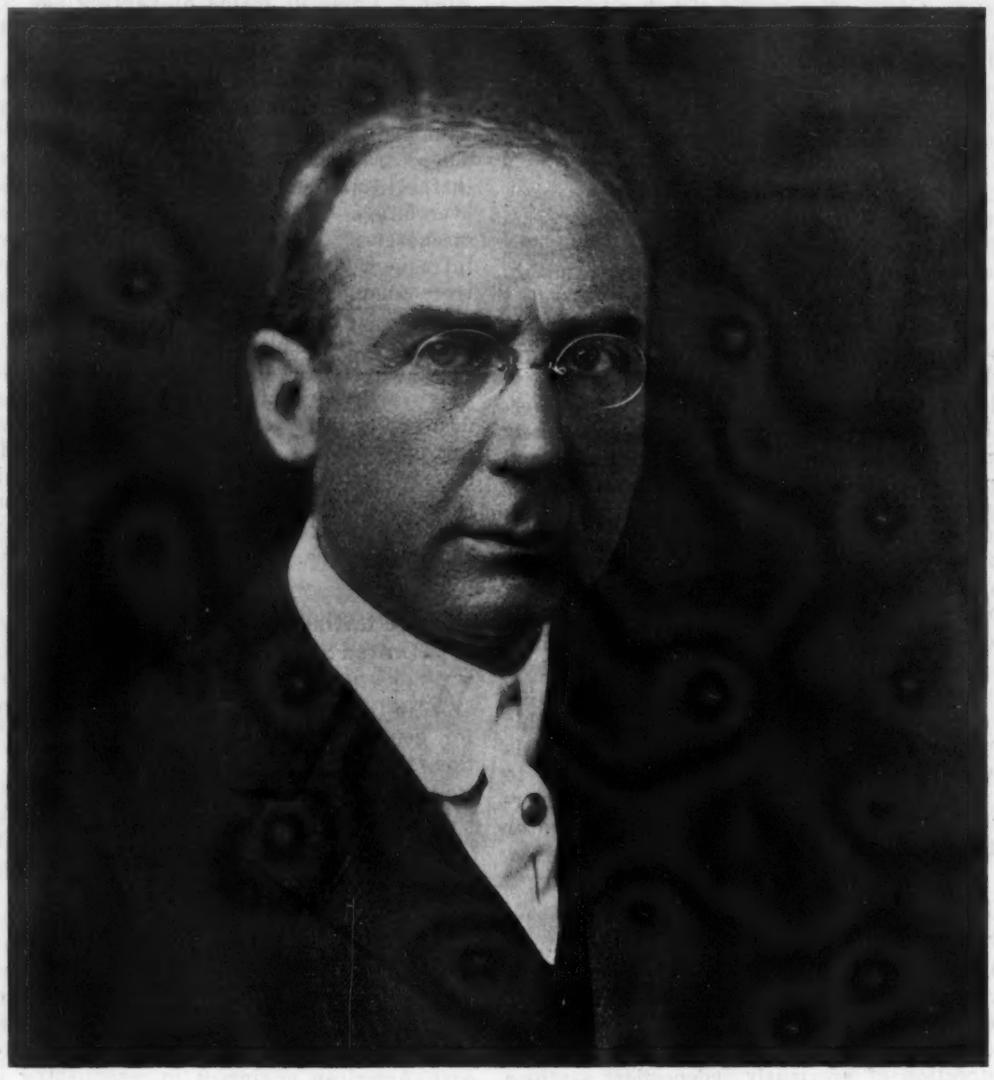
Voltage Ratings in the United States

WITH the growth of extensive transmission systems in this country, involving a multiplicity of voltages for generation, transmission, distribution and utilization, it has become necessary to eliminate as many as possible of those voltages that are little used or are not rational. It is also highly important to state specifically what is meant by the normal voltage of a transmission line, for instance, which may vary through a wide range over long lines. These matters will come up for discussion before the International Electrotechnical Congress, and it is particularly important that the American viewpoint should receive the fullest consideration from engineers abroad as well as in this country.

As we have pointed out before in these columns, engineers in other countries are ready to co-operate with American engineers in establishing international rules which shall represent the best practice in any country, and they naturally look for enlightenment to any nation which has had particularly valuable experience in any phase of electrical development. In the matter of high-tension transmission practice much of the pioneer work has been done in the United States, and the practical experience gained in the operating of large high-tension networks should go far toward the crystallization of international practice.

One point in particular which is brought out in the paper by Messrs. Newbury and Moore is of great importance when stating the system voltage for which apparatus is to be supplied. It is said that "in a system employing transformers the normal voltage of the system or circuit is defined as the highest rated voltage of the secondaries of transformers supplying the system or circuit." Such a definition should prevent connecting to the circuit any apparatus insufficiently insulated to withstand the maximum voltage stress to which it may be subjected.

That a large number of systems in the United States do not employ the standard utilization voltage, 110, was indicated in a table published in the ELECTRICAL WORLD for May 15, 1920, page 1136.



Samuel Macaw Kennedy

Who by advocating the Golden Rule as a fundamental principle has become a recognized leader in that rapidly growing school of public utility executives who believe in dealing with the public as a group of reasonable individuals

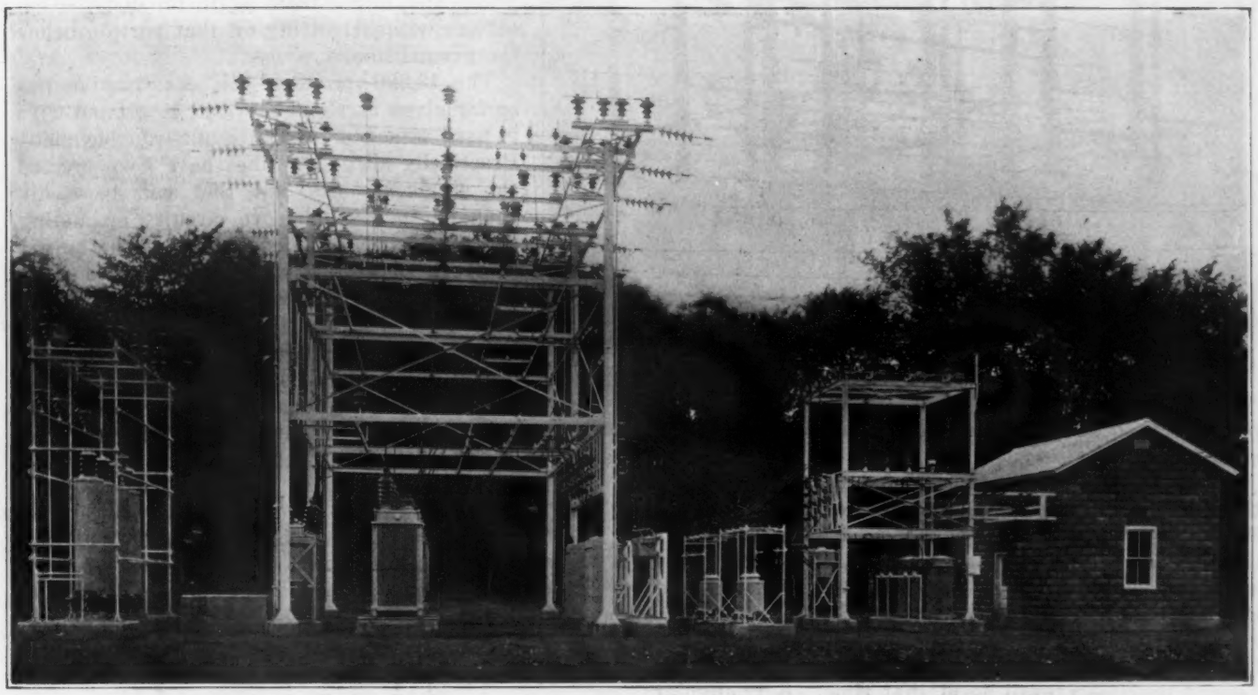
BY COMBINING a real business intelligence with a clear understanding that the psychology of public relations concerns the individual rather than the mass, S. M. Kennedy has shed new light on the great problem so fundamental to a full realization of the future of central-station service, namely, the establishment of public relations on a satisfactory basis. To Mr. Kennedy the public is not a unit but a great number of human beings, each one representing an individual service requirement that can be classified and adequately satisfied. Once one has caught this conception it is not difficult to understand why he places such emphasis on that old-fashioned courtesy in which a wholesome use of "I thank you" is the rule. Being a firm believer in the Golden Rule in business as well as social life he has never ceased to instill into the hearts of the men and women under his direction this homely doctrine. To Mr. Kennedy it is not idealism; it is a fundamental of good business. There has never been a doubt in his mind that a utility grows financially strong mainly as a result of making friends. Years ago he expounded the theory that the making of one enemy can undo the work of making a large number of friends. Another truth that he has discovered is that the utility as a rule does not really make friends or enemies for itself. Rather is this the result of the relationship of one individual to another. The individual employee dealing with the individual customer is the one who makes or breaks the confidence of the public. As Mr. Kennedy has repeatedly pointed out, the average human being sees the company through each of its representatives, whether it be the telephone operator or meter reader, salesman or "trouble shooter," cashier or lineman. It has taken a long while for these simple truths to receive more than passing attention. On the Pacific Coast, where Mr. Kennedy has long been looked up to as a leader, this philosophy of his has made a strong impression. Last May at the Pasadena N. E. L. A. convention it so fired those to whom it was expounded that it has spread like wildfire nation-wide.

Mr. Kennedy came into the industry by force of circumstance just a little less than twenty years ago. In that time the Southern California Edison Company, of which he is now vice-president in charge of business development and public relations, has grown until in point of output it stands fourth among the electric light and power companies of the United States. He has been prominently identified with all the forward movements on the Pacific Coast, including the California Co-operative Campaign, the beginning of a nation-wide co-operative movement. Mr. Kennedy was born and educated in Canada. For ten years he was engaged in his father's business of importing. At the age of thirty-one his health broke down and for five years he traveled in search of a congenial climate. In 1901 he became assistant to the president of the United Electric, Gas & Power Company, which in 1903 was absorbed by the Southern California Edison Company. Since that time he has guided the commercial end of the company's business. Mr. Kennedy's writings have received a very wide circulation. His essay "The Man on the Street" is probably the best known of them and is one of the brightest chapters in the literature of the industry. His latest volume, "Winning the Public," groups together all of his good-will precepts and is already becoming very popular.

Reducing Transmission-Line Interruptions

How One Company Made Use of Records of Transmission-Line Troubles to Locate Faults in Construction — Interruptions per Mile Reduced 90 per Cent in Ten Years

By F. I. BOWLER
Electrical Engineer Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.



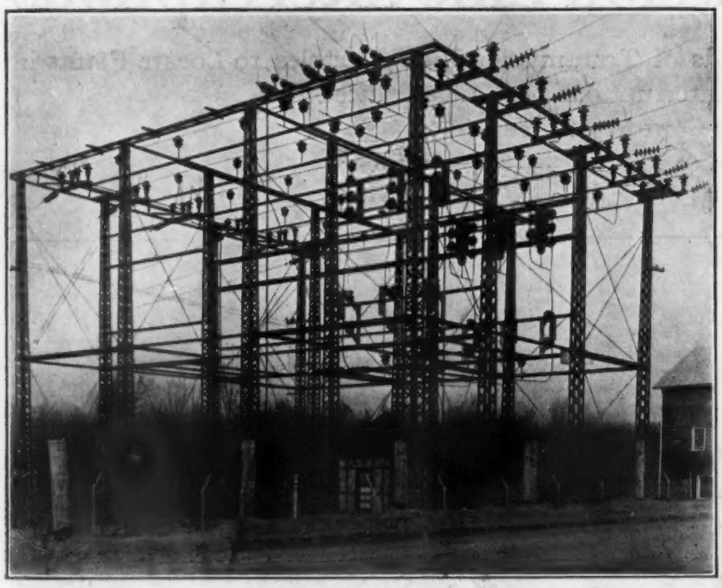
EXEMPLARY CONSTRUCTION WORK, SAUGERTIES (N. Y.) SUBSTATION AND LINE-SECTIONALIZING TOWER

BY KEEPING a record of transmission-line trouble and by systematic analysis of the record it has been possible to effect a marked reduction of interruptions per mile of circuit on the lines of the Central Hudson Gas & Electric and associated companies. As a result of this study it has been decided not to use pin insulators in a horizontal position in the future, owing to weathering effects. Suspension units without cement have also been adopted for railroad crossings, and many minor changes have been made in transmission-line construction by careful analysis of experience shown by the records. A summary of the records for ten years shows 593 interruptions attributed to twenty-four different classes of trouble.

These companies furnish electric service in the Central Hudson River Valley, including the industrial cities of Newburgh, Poughkeepsie and Kingston and part of the Catskill Mountain summer resorts. The main generating station is a steam station at Poughkeepsie. This is supplemented by hydro-electric stations at Hunter and Cairo, in the Catskill Mountains, and in times of emergency by standby steam plants at Newburgh, Kingston, Saugerties and Catskill. A 5,000-kw. hydro-electric station is now under construction at Rifton, on the Wallkill River. The steam plant at Rhinebeck is operated independently of the main system. As is generally the case, the various companies and plants were first operated independently and afterward connected by transmission lines in order to lower

TABLE I—FEATURES OF TRANSMISSION LINE CONSTRUCTION ON CENTRAL HUDSON SYSTEM

Name of Line	Year Built	Type of Construction	Type of Insulator	Rating	Wire	Ground Wire	Length, Miles
River	1911	Single-circuit	Pin	33,000	No. 2	Steel	14
(Highland-Balmville)	.....	Ground wire and bayonet	.....	.....	Solid cu.	.....	.....
Ohioville—New Paltz	1909	Single-circuit, ground wire and bayonet	Pin	33,000	No. 2 solid Cu.	Steel	3
New Paltz—High Falls	1909	Single-circuit, ground wire and bayonet.	Pin	33,000	No. 3 Cu, equal A1	Steel	8
New Paltz—Walden	1912-13	Single-circuit, ground wire and bayonet.	Pin	33,000	No. 2 Cu	Steel	14
(Walden-Balmville)	1914	Single-circuit, ground wire and bayonet.	Pin	33,000	No. 2	Steel	9
Kingston—High Falls	1908	Single-circuit	Pin	33,000	No. 5	None	10
Walden—Blooming Grove	1916	Single circuit, ground wire and bayonet..	Pin	33,000	No. 4	Steel	15
Main steel tower line	1917-18	Double-circuit	Susp.	66,000	No. 1/0 strand.	.....	48
Poughkeepsie—Athens	.....	Steel towers, one ground wire each circuit in nearly vertical plane	Five for straight susp., Six for strains	.....	H.D. Cu	Copper-clad	.....
		13,200-volt lines					
Kingston-Saugerties	1917	One circuit—three wires on one arm.	Pin	13,200	No. 4	Steel	12
Kingston—Port Ewen	1914	One circuit, three wires on one arm.	Pin	13,200	No. 4	Steel	6
Milbrook—Poughkeepsie	1920	Single-phase	Pin	17,000	No. 4	None	14
Catskill—Ravena	1912	Pole-top pin	Pin	15,000	Nos. 6 and 8	None	17
Catskill—Mountain	1906	Pole-top pin	Pin	15,000	No. 6	None	22
Saugerties—Diamond Mills	1920	Single circuit, ground wire and bayonet..	Pin	17,000	No. 1/0	Steel	2



AMPLE CLEARANCES TO GROUND FORESTALL SERVICE INTERRUPTIONS

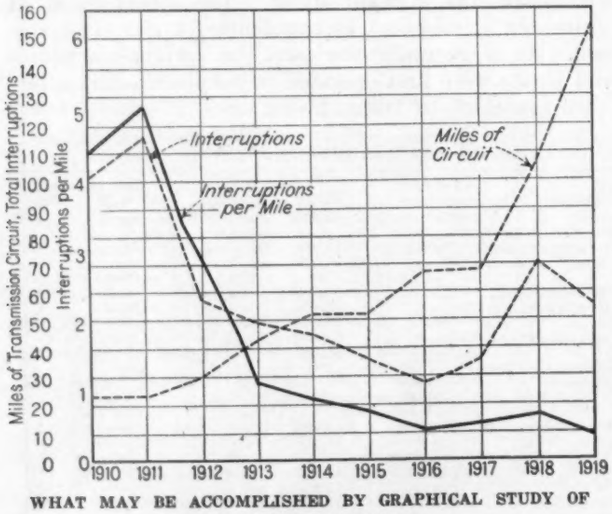
production costs and secure larger capacity in reserve equipment.

The transmission-line table shows the main lines of the company and their general characteristics. Practically all of the lines are constructed with a two-wire telephone circuit which connects the various generating stations and substations to the office of the system operator at Ohioville.

The first 33,000-volt line was constructed by the Central Hudson company in 1909 in accordance with the general practice prevailing at that time. A triangular pole-top construction was adopted with the pole-top pin bolted through the pole to a galvanized angle-arm bayonet which supported a stranded steel ground wire, grounded at every fifth pole.

IMPROVEMENTS IN TRANSMISSION-LINE CONSTRUCTION

In 1913, after an investigation of the operating results of the system, it was deemed advisable to remove the pole-top insulator from metallic contact with the ground wire. Accordingly the insulators were mounted on a short top arm with a great improvement in operation. The present standard 33,000-volt wood-pole construction is the result of ten years' operating experience. Up to the present time only chestnut poles have been used. They are all treated with a preservative compound with excellent results.


Miles of Transmission Circuit, Total Interruptions
Interruptions per Mile
Interruptions
Interruptions per Mile
Miles of Circuit
1910 1911 1912 1913 1914 1915 1916 1917 1918 1919

WHAT MAY BE ACCOMPLISHED BY GRAPHICAL STUDY OF INTERRUPTION RECORDS

In 1918 several miles of wood-pole line were removed and replaced with steel towers. The poles were in such good condition that it was practicable to use them again for distribution service without cutting off that portion below the ground line.

The 13,200-volt wood-pole construction has so far given excellent service. A ground wire is used attached to steel angle-iron bayonets. Practically all of the lines have been erected for single circuits, but they can be easily changed to two or more circuits by adding additional arms. In connection with the use of overhead ground wire it has been our experience that it does not prevent spill-overs at insulators with resulting momentary interruptions, but it has apparently eliminated the failure of poles and cross-arms by direct stroke and long interruptions to service due to necessary renewal of poles and insulators. The resultant time saving is a very important factor in restoring service.

HOW THE OPERATING RECORDS ARE USED

Since the year 1910 the system operator has kept a record of all interruptions. This has been of great assistance in analyzing the operation of the lines. At regular periods the engineering department reviews this record, conducts any necessary tests of old and new equipment and consults with other engineers as to the best present-day practice. Definite recommendations are then made to the operating department as to methods by which it can replace faulty equipment and obtain better results.

TABLE II—REPORT OF INTERRUPTIONS ON HIGH-VOLTAGE LINES

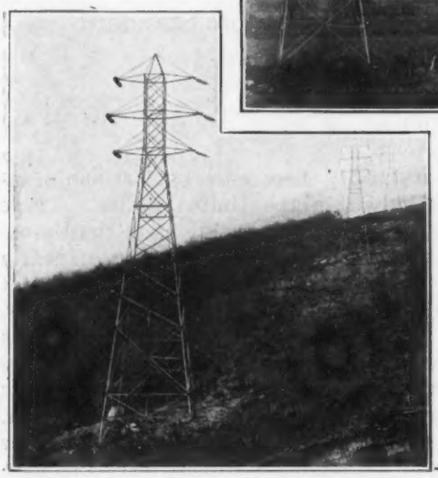
Cause	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	Total
Short circuit	12	6	14	2	4	..	..	..	..	2	40
Overload	15	10	5	..	..	..	..	..	..	3	33
Unknown	29	14	..	4	3	1	4	6	12	8	81
Line down	..	..	6	..	..	..	..	..	..	..	6
Substation	..	5	5	4	5	3	4	2	2	7	37
Generating station	6	13	3	2	4	2	2	5	2	2	41
Trees	9	12	..	16	18	6	3	1	1	6	72
Phasing in	..	1	..	1	1	..	..	..	..	1	4
Connecting lines	..	..	..	1	..	2	2	..	3	..	8
Lightning	18	27	10	10	5	11	9	12	24	12	138
Insulators	6	15	6	8	..	2	..	4	4	7	52
Storm	..	..	..	..	2	2	..	..	1	1	6
Error	..	..	1	1	..	3	..	1	3	3	12
Blasting	5	1	..	..	..	..	1	1	..	..	8
Ground	..	10	6	..	1	..	..	..	..	..	17
Line trouble	..	..	..	..	2	..	1	1	1	..	5
Wire	..	1	..	..	..	..	1	1	5	..	8
Birds and animals	..	..	..	..	..	..	1	1	5	1	8
Underground cable	..	..	..	..	..	..	..	..	3	2	5
Submarine cable	..	..	..	..	..	..	..	..	2	..	2
Malicious	..	..	..	..	..	..	..	..	1	..	1
Accidents	1	..	..	..	..	..	..	..	1	..	2
Water supply shut off	..	..	1	..	..	..	..	..	..	..	1
Cross-arm and pins	..	1	..	..	4	..	..	1	..	..	6
Total	101	116	57	49	45	36	28	36	70	55	593

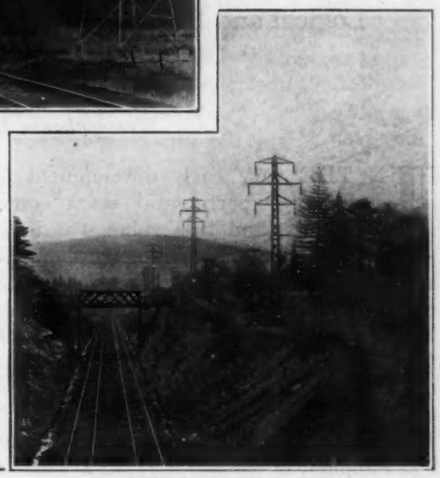
The record shows every interruption of any part of the main high-voltage system. A large percentage of the interruptions are only of short duration, being caused by overloads, short circuits, lightning and unknown causes. Several of the substations are equipped with reverse-energy relays which have acted to maintain voltage on the substation bus so that

an interruption does not always mean the loss of voltage on all parts of the system. An interruption is classified as the loss of voltage on any of the transmission lines or substations.

The interruptions per mile of transmission line per year probably summarize the results obtained to best advantage. A graphic chart is also maintained for general record purposes over a period of years. The different interruptions are classified and graphically shown by suitable colors and cross-hatching, and the large number of lightning interruptions are especially noticeable during the lightning season.

Since January, 1918, a graphic daily cut-out card record has been maintained. This method is described in detail by W. L. Robinson in the *A. I. E. E. Proceedings*, 1917, page 1073. This has been of use to both the operating and commercial departments. The effect of heatless days, daylight saving, the influenza epidemic, etc., is brought out on a card record of this character in an excellent way.





TYPICAL 33,000-VOLT CONSTRUCTION OF CENTRAL HUDSON GAS & ELECTRIC COMPANY

Left — Standard tower with guys at sharp angle turn. Top — Suspension insulators without cement are used at railroad crossings. Right—Narrow base tower is particularly useful for limited right-of-way.

We believe our experience with transmission insulators is very similar to that of other companies of the same size. However, a résumé may be of interest. The 33,000-volt insulator in use on practically all lines was designed about 1907 and possesses the general characteristics of that design period. Tests made when first installed, after four years' and nine years' service, show virtually the same wet and dry flash-over values, but the last tests show a drop from an average of about 212,000 volts to 180,000 volts in puncture under oil.

HORIZONTALLY MOUNTED PIN INSULATORS FAIL

After several failures in service tests of equipment removed from service and an analysis of the experience of others, it was decided not to install pin-type insulators with the main axis horizontal. It is our experience that the action of the weather on insulators mounted in this position materially increases the depreciation and leads to ultimate failure by puncture of the insulator. A large percentage of the total number of horizontally mounted 70,000-volt insulators failed in service under 33,000 volts after being erected from six months to a year.

A very similar experience has been had with suspension insulators used as strains for crossings of important highways, railroads, telephone lines and outdoor substations. It has been necessary to replace the old-type suspension insulators with modern types having no cement in their make-up. The suspension and strain insulators used on the steel tower line have not given any trouble. This may be due to the fact that the line is insulated for 66,000 volts and operates at 33,000 volts. Wood-pole lines are patrolled weekly and steel-tower lines monthly. This has been found sufficient for our operating conditions. After experience with horizontally mounted suspension insulators for railroad crossings, it was decided to omit these from later designs, using instead two pin-type insulators with a special arcing shield. This design has received very favorable comment from railroad and telephone engineers and has given excellent service for the short period of a year in which the design has been in use.

Considerable trouble was experienced with weatherproof triple-braid, twisted-pair leads used from telephone lines to substation sets and for several long runs. During the past three years this wire has been gradually replaced with two wires run on independent insulators with greatly improved service. Combined lightning arresters and fuses of heavy construction with one-to-one transformers are used for protection with good results. The lines are generally very quiet when consideration is given to the fact that only on the lines built since 1914 are the high-voltage circuits transposed. Previously it had been considered good practice to run lines without transpositions.

Very little trouble has been experienced with apparatus. In one case reverse-current relays were crossphased, giving about 60 per cent correct operation.

The connections were changed and no further trouble has been experienced. Lightning protection has generally kept pace with the latest improvements, changing from multi-gap to electrolytic arresters, adding first a charging resistance, later sphere and impulse gaps, and finally a new type of arrester which does not require daily attention.

The company operates 5 miles (8 km.) of underground and 2 miles (3.2 km.) of submarine cable at 13,200 volts. In addition there is a short run of about ½ mile (0.8 km.) of 5,720-volt submarine cable. All cable has varnished-cambric insulation with lead-sheathed, steel-armored wires, a portion of it having rubber insulation next the conductors.

The most serious interruptions from cable failures have been from trouble in the joints. In one case one of the underground cables feeding Newburgh failed and the trouble was located by means of a vibrator and exploring coil. It proved to be in a splice, the manhole being filled with water. Considerable damage from water penetrating the cable insulation resulted, but upon replacing a certain amount of cable and making a very careful splice operation of this cable it became satisfactory, and has remained so ever since.

One of the No. 2/0 submarine cables gave evidence of trouble and soon afterward failed completely. The fault was located very closely by the Varley loop test, and upon raising the cable from the river the cast-iron box surrounding the lead sleeve was found fractured. This box appears to have failed owing to the cast iron being put in tension. Investigation of the cable showed water had penetrated a distance of about 1,200 ft. (360 km.), and accordingly the greater part of the cable was replaced.

In making splices in this new cable the electrical connections were staggered in what is known as the "duct splice" method. This gives factory-applied insulation between phases and results in a much smaller sleeve. The armor wires were carefully interlaced from both ends over this sleeve and no cable box was used. The method has proved entirely satisfactory over two years of service.

Rational Practice in Voltage Rating

Reasons Leading Up to Development and Application—Where Standardization Does Not Exist Logical and Economical Practices Have Been Established—Field for More Standardization—Classification of Systems Into Four Groups

By F. D. NEWBURY and R. W. E. MOORE
Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

IN THE very early development of the electrical industry experimental work commonly employed 100 volts, and this value was used on account of limitations in lamp construction. Lamps and other simple devices were constructed for this voltage. Generators also were commonly designed for 100 volts. There was, however, a tendency for distributing circuits to increase in voltage. This was due partly to the desire to reduce the effect of voltage drop by increasing the base voltage, but largely to the influence of the carbon incandescent lamp, which, for practical reasons, was supplied to the industry in a wide range of voltages from 100 upward. These lamp voltages ranged from 100 volts to 130 volts and brought into existence a corresponding range of utilization circuit voltages. The present practice shows a variation in circuit voltages of from 110 volts to 120 volts. This condition retarded standardization for a long period of time and has made it difficult to accomplish.

The tendency for voltages to increase seems to be universal. Direct-current traction voltages may serve as a typical example. Since 1900 traction voltages have increased from 500 volts to 550 volts, and during the past ten years to 600 volts. This general tendency for voltages to increase as soon as put into use is mentioned only to indicate the reason for the basis of 110 commonly used, and also to suggest the difficulty of maintaining for any length of time a standard based on any lower voltage.

In this connection some statistics may be interesting showing the magnitude of the field covered by the present discussion and consequently the extent to which these standard practices have become well established.

In a single year (1919) there were 182,000,000 incandescent lamps sold within the United States. There are nearly 6,000 main generating stations in the United States having an aggregate generator rating of nearly 13,000,000 kva. and representing a capital investment of between two and one-half and three billion dollars. This does not include isolated plants, power stations serving only one manufacturing plant, nor the plants operated by electric railway companies for their own power. There are 126 power plants of over 20,000 kw. capacity. The rapid increase in the number of new alternating-current generating stations makes this subject of standard alternating-current voltages particularly important at the present time. In the United States alone, for example, 226 *new* central stations were built in 1919. Of the central stations (stations generating power to sell) in the United States nearly 80 per cent use entirely alternating current only and an additional 10 per cent use a combination of alternating and direct current. In addition to the figure given above, there are a very large number of isolated and industrial generating plants as indicated by the census of 1917, which showed 45,000 such plants.

How Systems May Be Classified

Systems and apparatus, from the standpoint of voltage standardization, may be conveniently divided into four groups. This division into classes is employed only for the purpose of presenting this subject in the clearest form, and the limiting values employed in each class are not to be considered as representing definite limits in practice. The four groups are:

1. Relatively small systems (up to 1,000 or 2,000

kva.), with voltages up to 2,400, in which generators may be directly connected to the utilization circuits, or step-down transformers may be used (Fig. 1).

2. Systems of medium size (up to possibly 20,000 kva.), supplying urban communities of medium size, using generator voltages up to and including 13,200, and which may or may not use step-up and step-down transformers between the generators and distribution circuits (Fig. 2).

3. Systems of large size (larger than class 2 and up to approximately 100,000 kva. or 200,000 kva.), serving

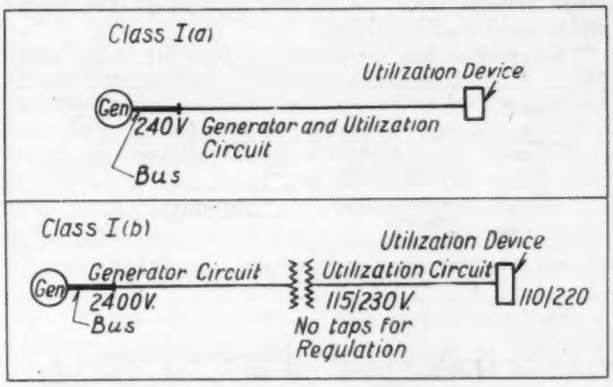


FIG. 1—REPRESENTATIVE DIAGRAMS FOR SMALL SYSTEMS

the largest urban communities or supplying areas of considerable extent by transmission lines, employing voltages up to roughly 88,000 and having step-up and step-down transformers (Fig. 3).

4. Large, long-distance transmission systems employing voltages up to 220,000. From the standpoint of standard voltages this class is simply an extension of the preceding class (Fig. 4).

The accompanying table gives a somewhat complete list of the values used in practice as the normal voltages for circuits in the several classes of systems.

The utilization device voltages given are those which are standard for a very large amount of apparatus using current, especially motors, but there are some devices supplied at other ratings. This is particularly true of lamps.

A word of explanation concerning the terms used in the illustrations of typical systems and in the above tables may be necessary. Circuits may be conveniently divided into four main classes:

1. The *generator circuit* is the part of the system from the generator to the station bus. The same voltage value is considered to exist throughout the generator circuit, which obviously is the generator voltage, and it is convenient to omit the word "circuit" in referring to the voltage of this part of the system.

2. The *transmission circuit* is the part of the system in which bulk power is transmitted from one locality to another locality; it is that part of the system between the secondary of the station step-up transformers and the primary of the step-down transformers serving the distribution circuit. The transmission circuit may be divided into primary and secondary transmission circuits when several transmission lines at reduced voltage are tapped off the main or primary transmission circuit.

3. The *distributing circuit* is that part of the system consisting of the distributing network.

4. The *utilization circuit* is that part of the system to which lamps, motors, heating apparatus and other utilization devices are connected. A distinction is made between the voltage of the utilization circuit and the voltage of the utilization device which represents the conventional voltage drop in the utilization circuit.

It will be noted at once that generator voltages in class 1 are multiples of twelve, while voltages in the other classes are multiples of eleven. The reason for this difference is the absence of transformation in the majority of installations employing low-voltage generators. Originally it was common practice to adhere to the same ratio in generator voltages as in voltages of other apparatus and the standard generator voltages were 220, 440, 1,100 and 2,200. However, as 110 and 220 became better established as the standard voltages and the requirements concerning uniformity of voltage in utilization circuits became more exacting, it was found that generators, supplying utilization without transformers, must be designed for higher voltages to provide for the necessary drop between generator and the consuming device. The lower voltages, 220 and 440, were the first to be changed to those higher values of 240 and 480, and there was a period when standard generator voltages were 240, 480 and 2,300, but this proved uneconomical from the generator standpoint, since it is convenient that the voltages within a given class be whole-number multiples of the basic voltages (in this case 120). Therefore the standard voltages of 240, 480, 600 and 2,400 were finally reached.

It has been pointed out that the development of lamps, motors and other utilization devices led to a basic voltage of 110. This in turn determined the common factor of eleven used throughout American practice for transmission, distribution and utilization circuits.

There is an apparent discrepancy between the voltage recommended for generators (240, 480 and 2,400) and the corresponding voltages recommended for distribution circuits for transformers (230, 460 and 2,300). Utilization devices of the same voltage may be supplied directly from both of those voltage sources. These differences arise from the different conditions existing in two cases.

1. There is more freedom in the choice of transformer locations with reference to the center of the load than in the case of generators, so that the permissible voltage drop between the generator and its load should be greater than between the distribution transformer and its load.

2. Transformers may be designed, as in the case in United States practice, to operate successfully within a moderate range beyond their rated voltage, while generators cannot be provided with this voltage margin without providing equal percentage increase in capacity. This also makes it possible to provide satisfactory voltage at the utilization device with the lower transformer secondary voltage.

Generators inherently have a fixed maximum voltage at the maximum rated load and rated power factor, because of the fixed exciting voltage, and a higher voltage cannot be maintained unless the excitation voltage is increased above its normal value. It is logical, therefore, to consider the station-bus voltage as establishing the system voltage where there is no step-up transformation. In systems having step-up transformers connected to the station bus the ratio of transformation establishes the normal voltage of that part of the transmission system. Several secondary transmission or distributing circuits of varying length and density of loading may be tapped off from this primary transmission circuit, each having its own load drop and

other service requirements. It has, therefore, become standard practice to provide transformer taps in the step-down transformers. The ratio of transformation in the step-down transformers, therefore, establishes the normal voltage of the distributing circuits.

It will also be noted that while the common divisor of voltages for transmission circuits is 11 (22,000, 33,000, etc.), the corresponding factor for distributing circuit voltages is 11.5 (2,300, 6,900, etc.).

It is American practice, for reasons of manufacturing economy, to design distributing transformers (up to 6,900 volts) feeding the utilization circuits without voltage taps. This makes it desirable to provide for a large part of the total voltage drop of the system at the point in the system where taps are available ahead of the distributing transformer. This is the reason for the higher basic voltage (115 instead of 110) in the distributing circuit as compared with the basic voltage in transmission circuits.

It will be noted that the total difference between the generator or secondary voltage of the step-up station transformers and the utilization voltage is based on approximately 10 per cent line drop. This value is subject to variations in practice, but 10 per cent represents, according to American experience, a fair compromise between reasonable cost and good service. It also represents a compromise based on practice that embraces the widest possible variety of conditions in cost of power, from one extreme of high-priced coal or oil to the other extreme of water power, and a wide variety in service requirements, ranging from large congested city conditions to transmission systems hundreds of

NORMAL VOLTAGES IN THE FOUR GROUPS OF SYSTEMS

Class	Generator Voltage *	Transmission Circuit Voltage	Distribution Circuit Voltage	Utilization Circuit Voltage	Utilization Device Voltage
No. 1a (Without distributing transformers; see Fig. 1 a)	240	.....	.....	.....	220
	480	.....	.....	.....	440
	600	.....	.....	.....	550
	2,400	.....	.....	.....	2,200
No. 1 b (With distributing transformers; see Fig. 1 b)	240	.....	.....	115	110
	480	.....	.....	230	220
	600	.....	.....	460	440
	2,400	.....	.....	575	550
No. 2 (See Fig. 2)	6,600	.....	2,300	115	110
	11,000	.....	2,300/4,000 Y	230	220
	13,200	.....	.....	460	440
	.....	.....	.....	575	550
	.....	.....	.....	2,300	2,200
No. 3 (See Fig. 3)	6,600	22,000	2,300	115	110
	11,000	33,000	2,300/4,000 Y	230	220
	13,200	44,000	6,900	460	440
	.....	66,000	11,500	575	550
	.....	88,000	13,800	2,300	2,200
No. 4 (See Fig. 4)	6,600	†22,000	2,300	115	110
	11,000	†33,000	2,300/4,000 Y	230	220
	13,200	110,000	6,900	460	440
	.....	132,000	11,500	575	550
	.....	154,000	13,800	2,300	2,200
	.....	220,000	.....	.....	.....

* The generator voltages as given are commonly accepted in the United States as system voltages where there is no step-up transformation.
† Secondary transmission circuits.

miles in extent. It is to be understood that closer regulation is obtained, when desired, as in city lighting circuits, by the liberal use of feeder regulators, or on transmission circuits by synchronous condensers.

There is another question that inevitably arises in any discussion of standard voltages. What is the normal voltage of the circuit? Voltages of widely different values exist in the same circuit in many practical cases owing to line drop, or in the case of long transmission lines with high capacitance the voltage at the receiving end of the circuit may be higher under light-load conditions, necessitating a reduction in the voltage at the generating station, or the equivalent to maintaining normal voltage at load centers. Engineering considerations of insulation margin of safety make it necessary to consider the highest rated voltage of any apparatus connected to the circuit as the normal rated voltage of the circuit. Then all apparatus that is to be connected to the circuit should be designed to have the recognized standard margin of safety based on this normal rated voltage of the circuit, even if, under usual operating conditions, a particular piece of apparatus is connected to a part of the circuit that operates at a lower voltage than the normal voltage of the circuit under same load conditions.

The practice has developed, in view of these condi-

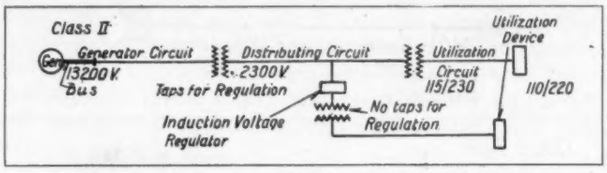


FIG. 2—SYSTEMS UP TO 20,000 KVA. AND 13,200 VOLTS

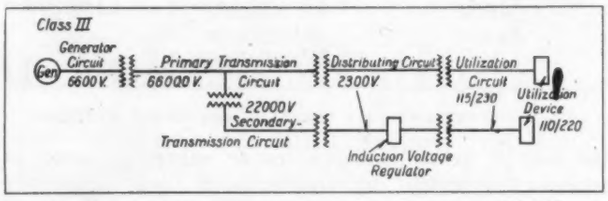


FIG. 3—LARGE SYSTEMS WITH VOLTAGES UP TO 88,000

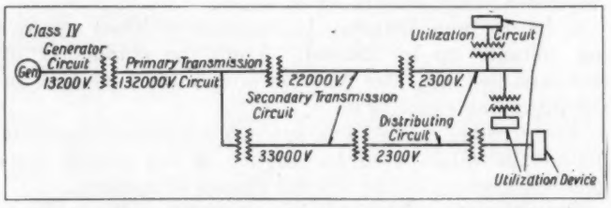


FIG. 4—LARGE SYSTEMS EMPLOYING EXTRA-HIGH VOLTAGE

tions, of defining the normal voltage of the system in the following terms. This definition and practice has been suggested for general adoption:

"In system employing transformers the normal voltage of the system or circuit is defined as the highest rated voltage of the secondaries of transformers supplying the system or circuit. This voltage rating applies to all parts of that particular system or circuit.

"It is to be understood that the standard rules for dielectric strength tests be based on the *normal* voltage of the system or circuit as defined above, and all dielectric strength tests shall be based on the normal voltage of the system, even if apparatus is applied on a part of the system which ordinarily operated somewhat below the normal voltage."

This definition of normal voltage is intended for application to all systems. Any definition of normal voltage of the circuit that is not based on the highest voltage existing normally in the circuit is, in effect, a reduction in the recognized margin of safety of the insulation; and, rather than accomplish such a reduction in margin of safety indirectly in this way, it would seem preferable to do it directly by changing the standard dielectric test rules. But the tendency in connection with the rules for dielectric strength seems to be in the direction of increasing the margin of safety rather than decreasing it.

Motor Features Requiring Standardization

In Order to Promote the Standardization of Mechanical Features of Motors Good Practice in Choice of Proportions and Materials for Parts Is Discussed—Special Purpose Motors Should Conform to Standards So Far as Possible

By C. W. STARKER
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THE necessity of standardizing mechanical characteristics of electric motors in order to hold down production costs and to facilitate their repair and maintenance in the industries was pointed out by the writer in an article, "Mechanical Design of Electric Motors," printed in the ELECTRICAL WORLD for April 24, 1920. In the present paper mechanical proportions and materials are discussed, showing the progress made toward standardization thus far and indicating problems requiring solution. The effect of various proportions and materials on the characteristics of the motor is fully considered.

PLANNING A LINE OF APPARATUS

A uniform and economical line of apparatus with a minimum number of different parts can be developed only if the entire line is mapped out from the start, not by designing each size as occasion offers, perhaps months apart. The first step in the case of a line of motors is a decision on horsepower ratings, speeds, voltages and so on. For a general-purpose motor this matter is fairly well standardized and uniformly accepted. For special purpose motors the different sizes of driven machine such as special machine tools, or other machines and their power requirements, are the determining feature.

Diameter and Length of Core.—The next step is to establish diameter and length of armature core or, for alternating-current motors, bore and width of stator core. Diameter and length together as D^2L presents a means for comparing volume of active material between machines of different design. Out of a given amount of material it should be possible to obtain a given motor output, assuming grade of materials, performance characteristics, such as efficiency or temperature, and finally the skill of the designer, to be the same. The D^2L may be plotted in a curve against the motor torque or horsepower per hundred revolutions (Fig. 1).

For purposes of comparison the D^2L for existing lines and competitive lines is plotted on the same curve. Having in this manner made a decision as to the diameter and length, we can still build a machine of large diameter and narrow core or choose a smaller diameter and correspondingly greater width. The principal considerations in this respect are, first, that the weight and cost of inactive material, including brackets, etc., increases with the diameter. The flywheel effect increases even with the square of the diameter, and this is an item of importance, particularly in reversing service or where frequent starting of the motors is required. On the other hand, a machine of small diameter and excessive length may be difficult to ventilate and to keep within the prescribed limits of temperature rise. The selection of proper ratios is therefore a matter of judgment and experience. Uniform steps of diameter and width should eventually be adopted as standard for the line. Frequently, particularly in the case of alternating-current motors, it may be desirable to design or even to build a rating two ways, that is, of small diameter and considerable width of core, or of the next larger diameter and next smaller step in core width.

Number of Poles.—With direct-current motors a similar border territory exists near the dividing line between two and four poles and between four-pole and six-pole designs. A 10-hp.-general-purpose motor for instance is uniformly built as a four-pole machine. In

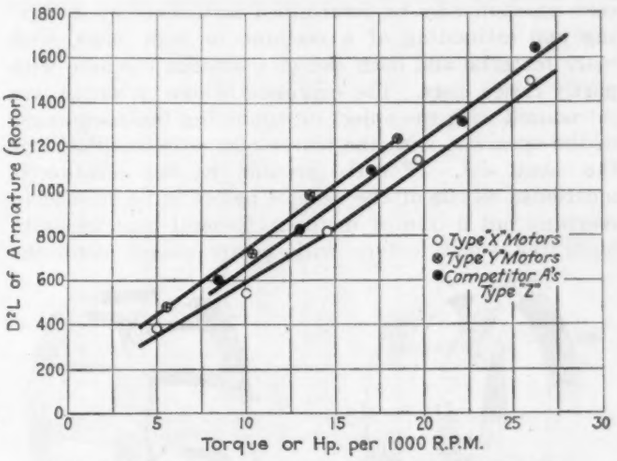


FIG. 1—RELATION BETWEEN ARMATURE PROPORTIONS AND TORQUE

the case of a 2-hp. motor there may be a choice between two and four poles and on a 50-hp. motor between four and six poles. In general, the lower number of poles means a larger amount of material both in magnetic section of frame and in commutator face, etc. On the other hand, the greater number of poles, field coils, brush holders, studs, etc., involves increased labor cost. The whole question is, therefore, a matter of cost comparison.

In regard to commutating poles the usual practice is to build the small two-pole machines without commutating poles, four-pole machines with two commutating poles (certain more or less special cases excepted), six-pole motors with six commutating poles. With the small motors commutating poles are omitted, as service conditions and possible gain by commutating poles, compared with the increased costs, are such as not to warrant their use. There is again a certain border territory where opinion differs and some manufacturers use commutating poles while others do not.

Having settled these general points, it is well, in mapping out a line of motors, to tabulate the principal data and results of preliminary calculation in tables.

Air Gaps.—In connection with alternating-current motors a decision must also be made in regard to air gaps and the use of open or partly closed slots. Minimum air gaps permit a minimum amount of material for a given output. On the other hand, inaccuracies and manufacturing variations in the punchings, in building of cores, in machining and assembling of parts,

and finally the item of bearing wear, require that for satisfactory service the air gap should not be decreased beyond a certain amount. Practice in this respect is fairly well established, namely, approximately 0.017 in. (0.43 mm.) for a 2-hp. or 3-hp. motor, increasing to a $\frac{1}{32}$-in. (0.79 mm.) single gap on a 15-hp. or 20-hp. motor.

Closed or Open Slots.—Closed slots are particularly advantageous from a purely electrical standpoint and effect a saving in active material. From a manufacturing and repair standpoint, however, the open slot with fiber wedge has the advantage of permitting the use of form-wound coils, easily inserted and removed from the slots, while the closed or partly closed slot makes it necessary to thread wire for wire through the small opening in the slot. Here is, therefore, a manufacturing consideration, a question of customer's attitude and a cost question to be weighed against one another. The cost question may be determined accurately by designing and estimating of a machine in both ways, with more material and open slot or a smaller machine with partly closed slots. The magnetic bridge or wedge was introduced with the object of combining the advantages of the open slot with the better magnetic conditions of the closed slot. For the present the slot question is mentioned as one of the general points to be decided in mapping out a line of motors. General practice is to build the small motors with partly closed slots, the

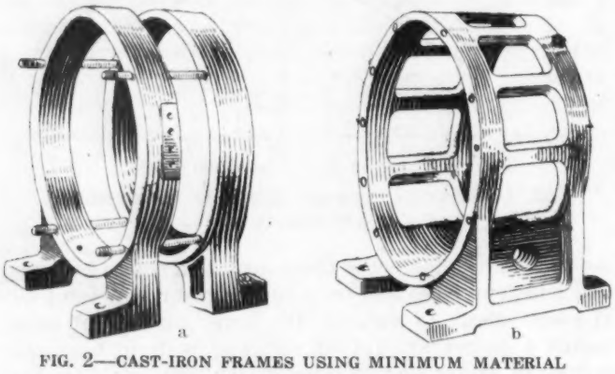


FIG. 2—CAST-IRON FRAMES USING MINIMUM MATERIAL
(a) Two rings riveted together. Feet are cast integral with end rings. (b) Skeleton construction.

larger sizes with either open slot or metallic wedge. The dividing line has varied considerably according to the tendency one way or the other of the manufacturer and motor users.

Choice of Materials for Motor Frames.—Considering direct-current motors first, the frame has the double function of a magnetic yoke and of a mechanical supporting member for poles, field winding, brackets, etc. Several different materials may come into question for possible use—cast iron, malleable iron, cast steel, forged steel and sheet steel. According to their magnetic permeability, these materials compare about as follows, at a magnetic density of 100,000 lines per square inch (15,500 lines per sq.cm.): Cast iron, 30; semi-steel, 41; malleable iron, 69; cast steel, 82; cast steel annealed, 87; hot rolled steel, 93; sheet steel, 98 to 100. For a given flux per pole at a given magnetic density the weight of a frame for these different materials would have to bear a ratio according to these figures. A cost comparison is still more instructive, but on account of the varying prices of castings and the item of labor, patterns and tools entering into the problem no generally applicable figures can be given. The above, however, sufficiently indicates the reason why cast iron today is practically abandoned as a material for direct-current motor frames except in the very smallest sizes of fractional horsepower motors.

Malleable iron is little used, as cast steel offers greater advantages at a very little greater cost, considering the possibility of reduced section. Hot rolled steel plate for direct-current motor frames came into commercial use some ten years ago and is today used on a very large scale by several manufacturers. Aside from lighter weight, there are the advantages of uniform cross-section, of freedom from blowholes, which means uniform motor performance, and of easy machining, drilling and tapping. Great flexibility of design is assured as rings are readily rolled of different width or thickness with the same equipment. Before these frames, formed into rings from universal mill plate or, within commercial widths, from bar stock, came into use it was proposed to roll up cylinders from steel bands, hoop steel, on edge and rivet the turns together. It has been suggested and actually tried to make motor frames, including pole projections, from sheet steel, punched in complete circles or in sections, built up and riveted. However, this idea, involving as it does considerable waste of material, great tool expense and labor in building, has not been able to hold the field, except perhaps for small fractional horsepower motors or very special cases. Today the rolled-steel motor frame appears to be the most efficient.

With alternating-current motors the frame has no magnetic function. It serves merely as a supporting member for the primary laminations, bearing brackets, etc. There are therefore several possibilities. Rolled steel in this case loses the advantage of superior permeability, but may be used on account of its strength and with a view to using existing equipment and parts in common with the direct-current line. As indicated in Fig. 3a, a special shape of punching or similar means is required with the straight cylindrical frame to obtain the necessary depth for the primary winding. Cast iron may be used and can be shaped to give sufficient strength and rigidity as well as provide proper ventilation and direction of air currents (Fig. 5). These two illustrations show different means for taking care of the varying core widths used within the same frame—a pin or pins in the center and bolts or rivets through the punchings in the former case; in the latter end plates of varying width or keyways milled at different distances from the center. The scheme of ventilation is indicated by arrows showing the direction of air currents in both designs. Coils as well as iron are effectively cooled by air currents passing over them.

If the cast-iron frame is reduced to the minimum required for mechanical strength, so that merely connecting ribs remain between the two sides of the motor frame, there results the so-called skeleton frame construction (Fig. 2b). It is, at least in the writer's opinion, a question whether there is sufficient gain in material saved, and there is undoubtedly a loss in rigidity, particularly in the larger sizes for this construction.

In designs used for alternating-current motors up to 15 hp. or 20 hp. the frame is often entirely omitted and the primary laminations are riveted together between strong end rings. These may be made of cast materials, or, more economically, if quantities warrant the tool expense, of pressed steel (Fig. 4). Large, tight-fitting rivets, driven under hydraulic pressure of about 25

tons and more, must be used with this construction, in order to insure reliability in rough handling and severe service. A large number of rivets is preferable, some manufacturers using twelve, others four. In either case they may be uninsulated, but they must be well out of the magnetic path. This construction may be further reinforced by a unit base (Fig. 2b) joining end rings.

The motor frame usually has foot projections, on which the machine rests. In severe service there is considerable strain transmitted through these parts and a strong construction is required. Ribs of large cross-sections are provided in the case of cast frames. With rolled-steel frames the design of a suitable foot presents some difficulty. Small motors may use a cast base, bolted on. On larger sizes and up to 150 hp. a riveted construction with the base made from malleable iron, cast steel or, best, from pressed steel has been in mechanical stiffness. The frame width is a matter of accommodating the maximum core width necessary and of easy accessibility for coil winding.

With direct-current motors the points to be observed in this connection are that the radial depth of the field coils must be sufficient to provide a sufficient number of square inches radiating surface of the coil in order to keep the temperature rise within the prescribed limits. Crowding of the field coils must be avoided to facilitate manufacture and to prevent grounds or shorts in the coils. With the cross-section of the frame determined by flux and magnetic density permitted, the decision is still open as to proportion between width and thickness of frame. The width should be sufficiently small to permit free ventilation. On the other hand, the thickness of the frame should be such that the flux coming out of the pole body can freely enter the frame.

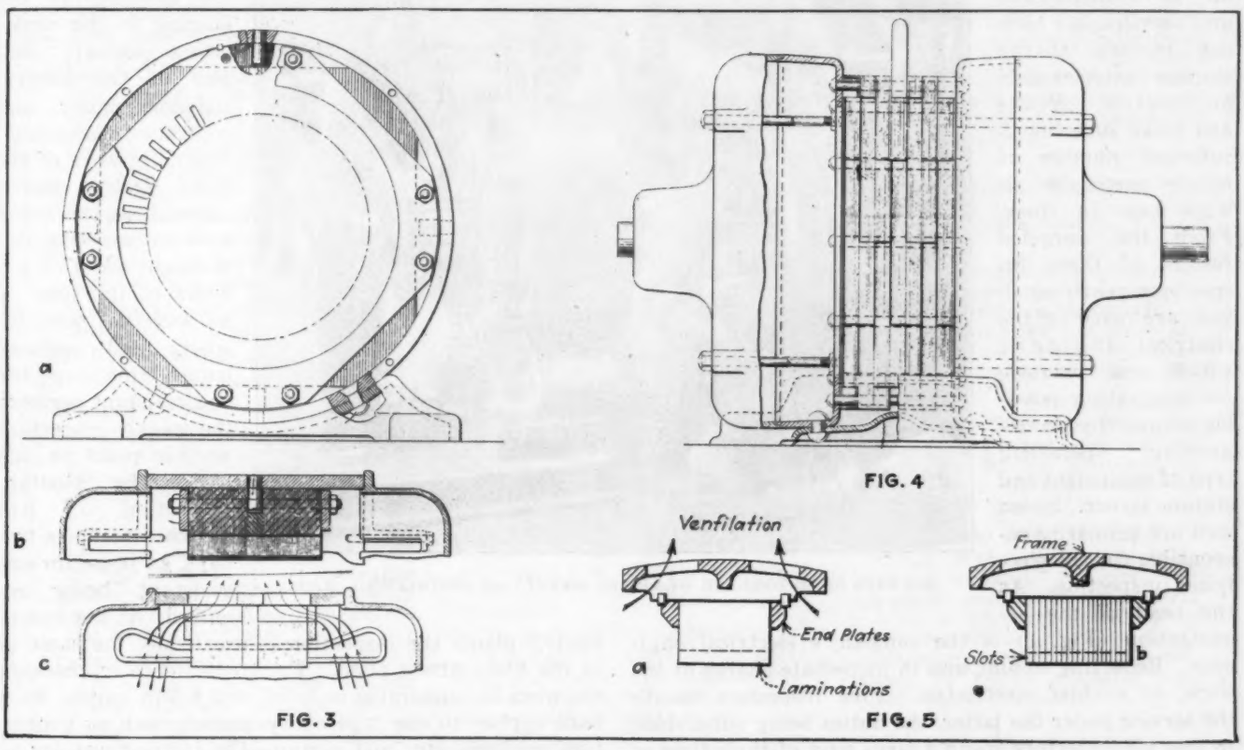


FIG. 3 FIG. 4 FIG. 5

FIGS. 3, 4 AND 5—SOME COMMON DESIGNS OF ALTERNATING-CURRENT MOTOR FRAMES

Fig. 3—Rolled steel frame, (a) arrangement of stator core, (b) support of stampings, and (c) ventilation scheme. Fig. 4—Pressed-steel rings riveted through core. Fig. 5—Sections of cast-iron frames with provision for different core sizes.

successful use for many years. The rivets in this case must be large in size and number and driven under heavy hydraulic pressure. With the rapid development in recent years of the electric arc-welding process and the increasing skill of the operators of welders, a solid forged foot, welded to the frame, has come to the fore and is used in actual service in considerable quantities.

Frame Diameter and Width.—In the process of mapping out a line of motors we have determined the armature diameter and core width and decided on the general construction of a frame. The next step then is to determine frame diameter and width. For alternating-current motors the frame bore follows from the inside diameter of the stator punching, plus slot depth, plus magnetic section required below the slot for the lowest number of poles to be designed on this rotor diameter. The outside of the frame is determined by requirements of ventilating space, coil clearance and This relation may be stated in the following form: Frame width times circumference of pole body should be equal to, or greater than, the cross-sections of the pole body. In small sizes the minimum frame thickness is also limited by the size of bolts required for supporting the bearing bracket.

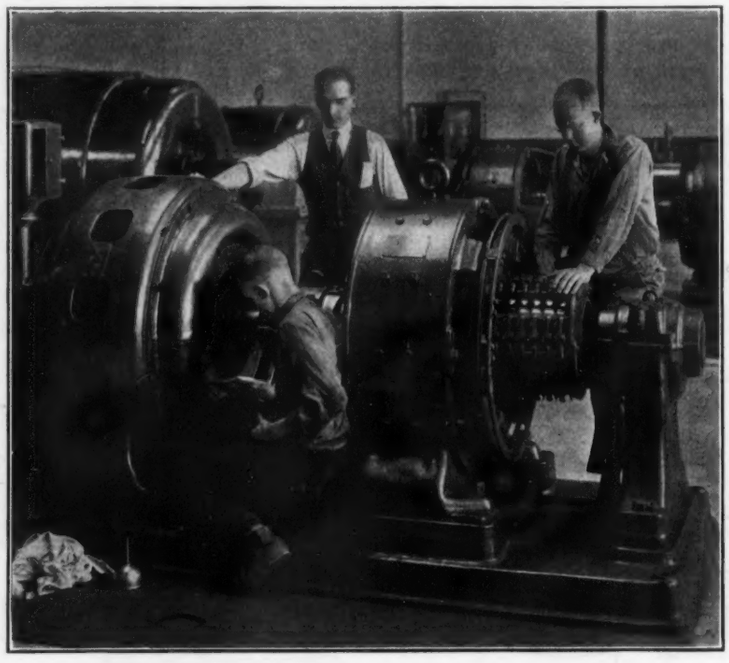
In working out the details of the design of a motor frame the usual attention must be paid to facility in making patterns and castings, avoidance of cores and loose pieces, simplicity of machining and interchangeability of drill jigs and of machining fixtures.

Uniform practice in regard to clearance for foundation bolts on general-purpose motors has been adopted as a recommended standard practice by the motor manufacturers (see Electric Power Club rules) so as to make these bolt holes practicable either for accurate setting on a machined base or for mounting on a rough concrete foundation.

Scheduled Inspection for Power Plants

Well-Ordered Routine Inspection of Electrical Equipment in Steam and Hydro-Electric Plants Catches Incipient Troubles—Analyses Made from Reports that Aid in Plant Administration

A DEFINITELY scheduled inspection system embracing simple instructions and records has been developed for the plants of the United Electric Light Company, Springfield, Mass. Special inspectors are employed who make daily, weekly, monthly, semi-annual and annual inspections in the steam plant and the hydro-electric plants. Besides inspecting all electrical equipment, these men make minor repairs, test and filter oil in transformers and switches, blow out motors, charge storage batteries used on control circuits and make sure that a sufficient number of repair parts are always kept in stock. From the compiled results of these inspections yearly analyses are made by the electrical engineer which are valuable for suggesting possible improvements regarding operation, type of equipment and station layout. Seven men are primarily responsible for the electrical inspection. At the head of the organization (Fig. 1) is the company's electrical engineer. Reporting to him, and in immediate charge of the work, is a chief electrician. Five inspectors handle the service under the latter, the duties being subdivided so that all inspectors spend a large part of their time at the main station, with excellent co-operation, a daily meeting being held at 8 a.m. One inspector handles the work at the two hydro-electric plants and spends the balance of his time at the main plant on more delicate inspection and maintenance of instruments and relays.



AIR GAPS OF MOTORS ARE MEASURED WEEKLY AT SPRINGFIELD, MASS.

The inspection program is most extensive for State Street, or No. 1 station, which is a 34,500-kva. steam plant. In the plant one 20,000-kva. unit, three 1,000-kva. units, and one each of 2,500, 4,000 and 5,000-kva. rating are in service. The plant is interconnected with the 66,000-volt transmission system of the Turners Falls Power & Electric Company through a transformer substation of about 22,500-kva. rating at State Street. At Indian Orchard is a 2,940-kva. hydro-electric plant and at Birchem Bend is a 640-kva. hydro-electric station, the main steam plant being about 6 miles (10 km.) from the two smaller stations. The auxiliary motors in all the stations total about 2,300 hp., of which about 2,000 hp. is located at State Street. Local distribution is at 5,500 volts, two-phase. These motors operate oil circuit-breakers (seventy-seven motors), drive arc generators, regulators, fans, pumps, coal-handling machinery (fourteen motors totaling about 200 hp.), etc.

The schedule of work for the steam plant is shown on page 923. In addition the daily routine includes oiling and wiping motors and testing potential transformer secondaries for open circuits. All motors are under the daily supervision of the operating force, and daily inspections are made of the blowers and motors belonging to the ventilating system, and also of the electric elevator motor and control mechanism. The daily work of the State Street station takes about two hours with an inspector and assistant and two hours of the time of an assistant who inspects and replaces lamps. One inspector and assistant perform the weekly inspection at this plant in one day. The monthly inspection of oil switches occupies two days, an inspector and assistant being required. At the hydro-electric plants the inspection is practically the same as at the State Street plant. For convenience in checking the work the apparatus is listed on 3 x 5-in. cards. Each card applies to one type of equipment, such as generators, exciters, etc., and contains the instructions for all inspections to be made on this type of equipment.

TABLE I—TROUBLES LOCATED BY INSPECTORS DURING A YEAR

Trouble Detected	Number of Times Reported
Fire extinguishers missing	8
Transformer valves leaking	2
Brushes gone on collector rings, generators or exciters, or brushes set improperly or sticking	9
Lightning arresters open-circuited	1
Field rheostat with burning contacts	2
Cranes developing flat wheels, grounds in crane wiring, resistors loose or broken	6
Control batteries defective	2
Switches running warm	1
Loose contacts	12–15
Oil breakdown tests below normal	1 Pair
Rubber gloves:	
Punctured	1 Pair
Broken down at 7,500 volts on test	Several
Relays, contacts bent or loose	1
Primary insulator on bus broken	
Oil switches faulty in operation due to worn or slipping clutches in mechanism	5
Reverse-current relays, open circuit	1
Ground wires cut off outside station	2
Oil-switch contacts requiring replacement	Many
Generator air-gap wedges coming out	1
Motor armatures rubbing	Several

Frequency of Inspections and Where to Look for Trouble

Weekly—Monday

Station Lights:

General Inspection for cleaning, etc.:

66,000-volt, 5,500-volt, 2,400-volt, oil switches and compartments.

Lightning arresters and compartments at Turners Falls Switch House and Tower and roof, complete with equipment; record charging current.

5,500-2,400-volt transformers.

All lighting services, boxes and receptacles.

Fire extinguishers.

Blowers and motors on ventilating system.

Elevator motors and control.

All motors under the care of operating force. (Blow out at the time of this inspection all open motors and examine for bearing wear, lubrication, etc.)

Generators and exciters, brushes, brush-holders, commutators and rings, etc.

Rotaries, brushes, rings, commutators, bearings, etc.

Rectifier Heating Lights:

I R S Regulator Relays and Contact-Making Voltmeters:

See that contacts are clean and leads well secured.

Arc Board Flexible Jumpers:

See that the insulation is intact.

Signaling Devices:

Try all devices for operation and make sure there are no loose contacts, loose dirt or foreign material to prevent satisfactory operation.

By means of lamps on P. F. potential bus, test for blown fuses on all power circuit potential transformers. With test lamp make same test on all other potential transformer leads.

Operators' Reports:

Investigate any such reports which have not been cleaned up from the previous week.

Brush Arc Machines:

Examine brush arc machines for evidences of trouble.

Storage Battery for Control:

See special instructions.

Monthly Inspections

Motors:

Inspect all motors and their controls and make any repairs required. Note any changes which might be made with benefit in the care and operation of the machines. Note any addition to list of station motors installed during the previous month.

Inspect all fuses and replace any that are incorrect, and report use of incorrect fuses.

Oil Switches:

Inspect all oil switches, try them for operation, and where solenoid-operated, operate them both by the solenoid and by hand. Lubricate at this time when necessary. Examine carefully for sticking or faulty operation.

The above applies only to such switches as may be operated without cutting off customers' service. (See yearly inspections for switches, the cutting out of which will interrupt customers' service.)

See that auxiliary contacts are cleaned and in correct alignment.

Oil very sparingly all moving parts equipped with oil wells or holes. See that the brush contacts and the stationary contacts on H-3 switches are cleaned and in good condition.

Relays:

Relay inspector should try relays on each switch and each phase when switches are out of service for the above.

Disconnecting and Expulsion Fuses:

Examine disconnecting switches for evidence of trouble, also expulsion fuses. Examine operating rods for both and see that they are in good condition.

Examine fuse pullers, test leads and hooks.

Storage Batteries:

Charge control batteries for No. 2 and No. 3 Stations and replace those in service by the one just charged.

Circulating Water Supplies:

Test all circulating water supplies to transformers, regulators and rectifiers for free circulation. Allow a full stream to flow through all cooling coils for two or three minutes to loosen up and remove accumulating sediment. Where the apparatus is equipped with open flow indicators, precautions will be necessary to prevent splashing.

Air Breakers (Relay Inspector):

Examine for heating and operation, airbreak circuit breakers with reverse current relays, remote-controlled field switches, etc.

Rubber Gloves:

Carefully examine and test electrically all rubber gloves left in the station for the operators' use. If these gloves show evidences of puncture or wear they are to be replaced and turned over to the chief electrician for test. When tested write date on wrist of glove, with water-proof ink, and initial.

Switchboards:

Examine in detail all instrument and control equipment on panels for loose, dirty or broken contacts or connections, improper or burned out fuses, etc.

Quarterly Inspections

Jan. 1, April 1, July 1, Oct. 1.

Test Transformer Oils:

Test oil in 66,000-volt transformers, 13,200-volt transformers and their regulators, and 5,500-volt transformers. Filter oil at the first opportunity if it tests below an average of 16,500 volts with 1-in. disks 0.1 in. apart.

Ground-Wire Connections:

Inspect all ground-wire connections on lightning arresters and high-voltage station apparatus. This wire is to be examined up to the point where it is attached to pipes, flumes, etc.

Rectifier Transformers:

See that the accumulated dust is removed from rectifier transformers by means of compressed air. In so doing, make sure that the air is dry and does not deposit moisture on the coils. Try rectifier dash pots, and if necessary adjust in accordance with the manufacturer's instructions. Give each rectifier tube in service heat treatment, in accordance with manufacturer's instructions.

Semi-Annual Reports

Nov. 1 and May 1.

Generators:

This is a complete inspection of generators including the removal of the end shields, inspection of generator windings, air gaps, air ducts, inlets and outlets, armature and field leads, thermometers, etc.

Relays:

Test and adjust all relays. On bellows-type relays the leather should be rubbed gently with neatsfoot oil the day before the relays are calibrated.

Repair Material List:

Check up the stock-room repair material on hand. See that new apparatus installed in the past six months is properly protected by repair material.

Make any suggestions with reference to repair material lists which appear necessary.

Yearly Inspections

June 1

Oil Switches:

Examine all 2,300, 5,500, 13,200 and 66,000-volt oil switches and contacts. Filter oil and replace where necessary.

General

Get shipping memos from stockkeeper and open and check all material received for new construction work, etc., where material is too bulky or where, for any other reason, it is not taken into stock and opened and checked by the stockkeeper in detail. Report all shortages at once.

The above does not, in any way, prevent the necessity for reporting at once any case of trouble requiring outside help or material not regularly kept in stock, or at that time out of stock, even though regularly kept in stock.

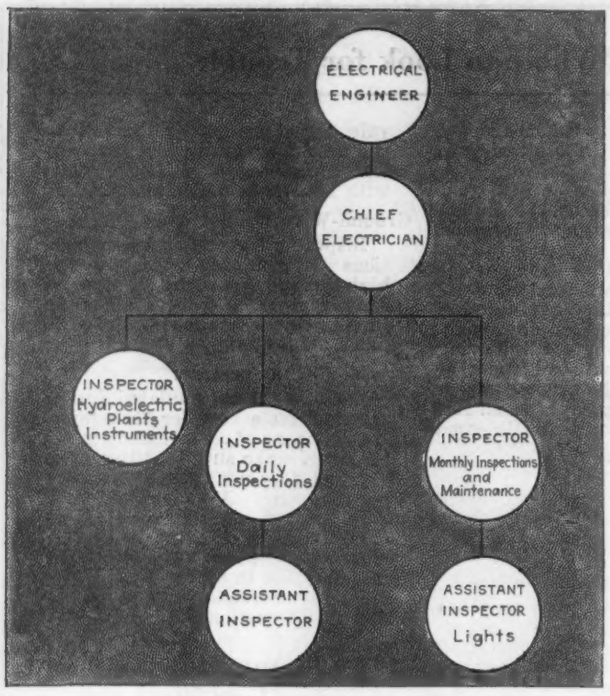


FIG. 1—SEVEN-MAN INSPECTION ORGANIZATION FOR THREE PLANTS TOTALING 38,000 KVA.

While it is impossible to tell in how many cases the inspectors have caught troubles which might have caused serious breakdowns later, the character of defects revealed by inspection affords excellent evidence of the value of the system. A recent analysis by J. P. McKearin, electrical engineer of the company, covering a year's inspection reports, showed, among other data, the conditions to be remedied listed in Table I. As an example of the value of the system it might be pointed out that in the case of the generator air-gap wedge becoming loose the consequences might have been very serious had the trouble not been detected. The unit was one of 20,000-kva. rating, and inasmuch as the wedges are of laminated sheets the coils might easily have been damaged had the trouble continued without being observed.

In conclusion, a few operating defects taken from an inspector's notebook are added as an indication of the importance of forestalling trouble.

NOTES FROM INSPECTOR'S NOTEBOOK

A 5,000-volt switch blocked by a stick dropped by painters.

The air-gap on a type H-3 switch magnetic clutch widened by the use of emery cloth.

Bell cranks improperly set, resulting in unequal movement of oil switch mechanism.

Loose brushes and rough slip rings.

Too many brushes down in starting rotary converter, due to broken clips.

Hot blades on knife switches, due to spread clips.

Lamp and fuses missing or blown on emergency lighting circuits.

Water carried from air-washer into generator stator, one burnout resulting.

Distortion of field coils at bends due to loose winding and heating.

UNITED ELECTRIC LIGHT CO.
OPERATORS TROUBLE REPORT

Aug 3 1920
5:30 A. M.

Brushes sparking badly on #2 Rotary
Second ring from inside

Chip taken from all 4 rings 8/3/20 HC

Swift OPERATOR

UNITED ELECTRIC LIGHT CO.

#2 Station Generating Department Weekly Inspection 5-24-20

I hereby certify that the following apparatus has been examined and repairs made as noted below.

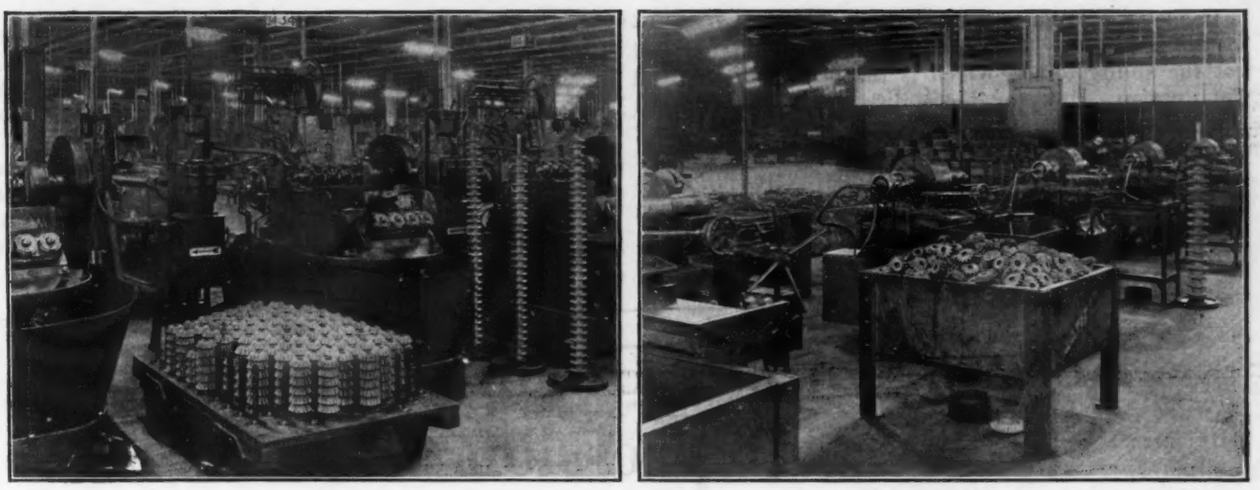
Generators OK
Exciters OK
Oil switches OK
Transformers OK
Rotaries OK
Arresters 13000 - 3 amp
6600 - 25-4 amp
changed solution in one 600v meter as it was low.
Rectifiers OK
Motors & controls cleaned contacts on T.F.R regulator switch
Regulators cleaned VM contacts on 201 & 202
Pot circuits OK
Signals OK put on battery just repaired at the factory.
Jumpers OK

1920
INSPECTION CHART
No. 1 STATION
UNITED ELECTRIC LIGHT CO.

LINE No.	APPARATUS QUANTITY	DUTY	LOCATION	SERIAL No.	HP.	1920 INSPECTIONS JANUARY DATE	JANUARY SIGNATURE	FEBRUARY DATE	FEBRUARY SIGNATURE	MARCH DATE	MARCH SIGNATURE	APRIL DATE	APRIL SIGNATURE	MAY DATE	MAY SIGNATURE	JUNE DATE	JUNE SIGNATURE	JULY DATE	JULY SIGNATURE	AUGUST DATE	AUGUST SIGNATURE
1		New Switch House Motors																			
2	45	H Oil Switches	Switch Compartments		0.9 1.5		A.M.S.		A.M.S.		A.M.S.		A.M.S.		A.M.S.		A.M.S.		A.M.S.		
3	24	IRS Regulators	Regulator Room		½		"		"		"		"		"		"		"		
4	1	Main Ventilating Fan	Basement N.W. Side	46474	3	7	"	7	"	7	"	7	"	7	"	7	"	7	"		
5																					
6																					
7																					
8																					

FIG. 2—FORMS USED FOR RECORDING RESULTS OF INSPECTIONS

Left-upper—Operator reports to inspector on this form any trouble which he has noticed while on shift. Right-upper—On this blank are recorded each piece of equipment inspected and a notation of trouble found and what was done to remedy it. Lower—On this sheet all equipment inspected is listed and checked after every inspection. The sheet embraces one year's inspection.



ABSENCE OF HEAVY SHADOWS IS NOTICEABLE IN THIS SHOP LIGHTING

Illumination of Machine Tools

Average Intensity Over Machines Is 15.35 Ft.-Candles in Plant of Central Gear Company—Conditions at Night as Pleasant as in Daylight

BY G. WAGSCHAL
Electrical Engineer, Esseltyn, Murphy & Hanford

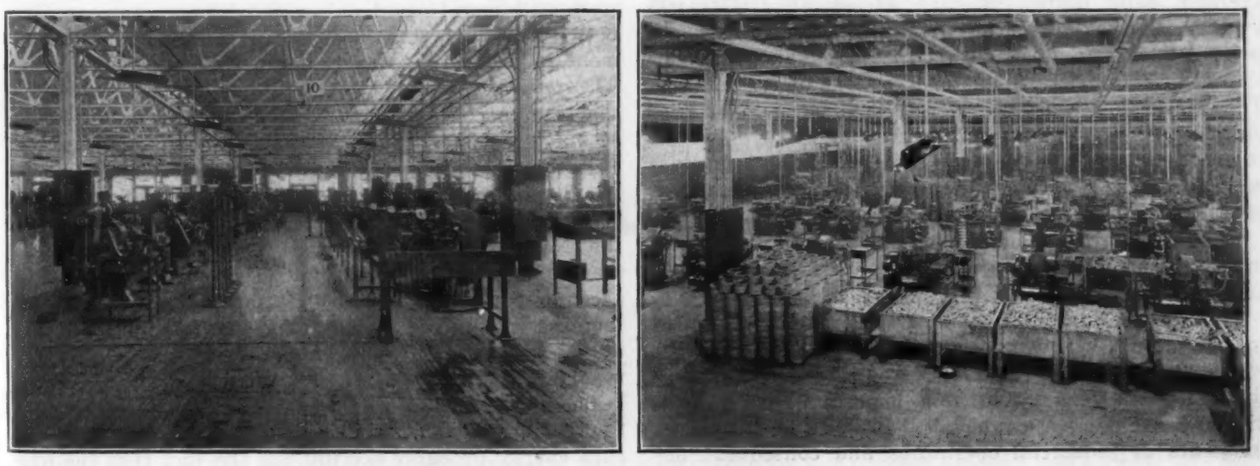
GOOD illumination is essential to the night operation of a plant if quality and quantity production are to be obtained. A soft, well-diffused light which will enable the operators to make accurate micrometer readings without undue eye strain should be provided. Dark spots, gloomy ceilings and shadows should be avoided because these things affect the morale of the workmen and morale is now recognized as an important factor in production. It follows, therefore, that initial cost, while important, should not be the primary factor.

The Central Gear Company of Detroit, which manufactures gears and transmissions for use in automobiles, has a lighting installation, as shown in the accompanying illustrations, which gives the results most desired by the factory management. The lighting equipment consists of 220-volt type F Cooper Hewitt lamps hung 10 ft. 6 in. (3.2 m.) from the floor and spaced 15 ft. x 16 ft. (4.5 m. x 4.8 m.) apart. There are two lamps on each circuit, and each circuit is controlled from a safety-type panel box, one of which is mounted on nearly every alternate column in the building. A 110-volt plug receptacle is also provided on every column to supply energy to small electric tools.

The average intensity of illumination over the machines was found to be 15.35 ft.-candles (165 lumens per sq.m.) and the average intensity of illumination in the aisles was found to be 10.85 ft.-candles (116.8 lumens per sq.m.). The energy consumption corresponding to these values was 1.6 watts per square foot.

Readings were taken for positions of maximum and minimum intensity over the machines and in the aisles at a working plane of 3 ft. 6 in. (1.07 m.) above the floor. The illuminometer readings were taken without a color screen because its accuracy is not above question. Furthermore, the results given can be used for comparison by others whether or not they have a color screen available.

The old empirical rule of 1 watt per square foot (10.8 watts per sq.m.) is being superseded by a careful study on the part of the illuminating engineer of all factors entering into the problem, giving due consideration to intensity, diffusion and proper distribution of light. The tendency today is toward a higher standard of factory illumination with increased visual acuity obtained by the utilization of higher intensities and by the elimination of glare.



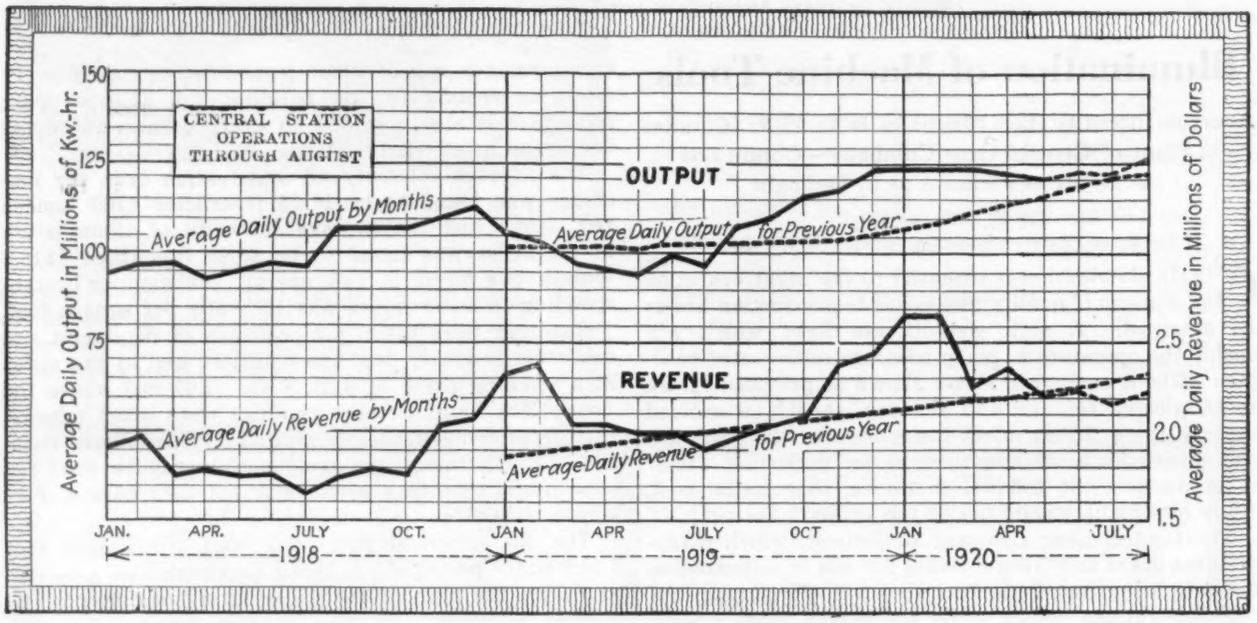
NATURAL LIGHT (LEFT) IS CONTRASTED WITH ARTIFICIAL LIGHT (RIGHT)

It should be remembered that the measuring instruments record only the intensities of illumination and not the ability to see, which is the prime object of all illumination. However, the ability to distinguish detail can be brought out by the camera, as the accompanying pictures show very clearly. It is interesting to note in comparing the photographs that better results were obtained with the artificial lighting than were obtained with daylight.

All the wiring in this plant is in conduit. Four No. 12 B. & S. (3.31-sq.mm.) two-conductor lighting circuits are taken from the lighting panels in 1-in. (2.54-cm.) conduit. The 1-in. conduit is carried to a central point in the roof trusses, and from there one circuit is taken in ½-in. (1.27-cm.) conduit to each pair of lamps.

All the efforts made to simplify the layout and to increase the value of the lighting installation to the factory manager are made for the sole purpose of continually increasing the quality and quantity of the factory output.

Record Output During Industrial Depression



THAT a new output record was hung up by the central stations of the country during the month of August is indicated by returns for that month received by the ELECTRICAL WORLD. For the first time in the history of the industry the average daily output was in excess of 125,000,000 kw.-hr. Owing largely to curtailment of operations in several lines of industry, this record advance was not shared by the strictly industrial sections of the country. The increasing seasonal energy demand for lighting purposes throughout the nation was sufficient, however, to overcome the small output increases in the industrial sections and establish a record for central-station operations.

Curtailment of production was more or less general in all sections of the country. The New England States, however, were especially affected. Boot and shoe, silk, woolen, cotton and textile mills were seriously curtailed in operations. It was reported that the number of woolen mills idle during August was as great as during the semi-panic year of 1907, and many mills were working on a five-day-week schedule. In spite of these curtailments in industrial operations and consequent decrease in power demand, the central-station output in New England for August was about 2 per cent greater than that of July.

Steel-ingot production during August was the largest since December, 1918, with the exception of February and March of this year. It was reported that steel mills were still operating at only about 80 per cent capacity, notwithstanding this increase in production. Curtailment in production was reported in several industries. The returns for the Atlantic States indicate, however, that the output was about 30,000,000 kw.-hr. in excess of July's output.

Automobile production seems to have reached a working level, and very little additional curtailment was reported during August. Several other industries in the North Central States, however, reported curtailment of production in varying degrees, which probably accounts for the fact that, notwithstanding the seasonal increase in lighting demand, the central-station output of this section was approximately the same as that reported in July.

The pre-eminence in the lighting load of the South Central States and the increasing seasonal demand for such energy probably account for the fact that the output of that section increased about 5 per cent over July.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy			Percentage of Installed Ratings Represented	Kw.-Hr. Output		
		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
Sept.	53	$32,344	$28,336	14.0	53	1,761,582	1,695,862	4.3
Oct.	55	35,492	30,077	18.0	60	2,175,636	1,987,004	9.0
Nov.	53	37,439	31,927	17.2	58	2,055,428	1,895,693	8.2
Dec.	59	44,125	37,978	16.0	65	2,509,571	2,270,833	10.0
		1920	1919			1920	1919	
Jan.	57	46,614	39,002	19.8	67	2,581,096	2,186,732	18.0
Feb.	63	45,881	37,502	22.1	69	2,494,764	1,986,493	25.3
Mar.	65	46,155	36,840	25.0	70	2,698,890	2,103,587	28.0
April	65	45,547	36,541	24.5	70	2,603,692	2,098,559	24.1
May	65	43,888	35,512	23.4	70	2,631,560	2,179,916	21.2
June*	66	44,434	35,528	24.5	71	2,630,831	2,175,645	20.2
July†	66	46,634	36,272	28.4	71	2,682,723	2,238,252	20.0
Aug.‡	66	47,103	36,560	28.9	71	2,770,741	2,287,394	21.5

*Includes estimates for twenty-three companies, representing 2.9 per cent of the total installed rating of all central stations.
†Includes estimates for thirty-eight companies, representing 5.5 per cent of the total installed rating of all central stations.
‡Includes estimates for eighty-two companies, representing 14.6 per cent of the total installed rating of all central stations

Labor and industrial conditions throughout the Mountain and Pacific States were reported as good in August with the exception of the lumber industry, which was operating at less than 75 per cent capacity and many lumber mills were completely shut down. Lack of sufficient rain in the mountain regions of California was causing considerable worry and restricting the extension of operations in that state. In spite of these facts, however, the central stations of the Mountain and Pacific Section reported a record output of 808,000,000 kw.-hr. for the month of August. This section still holds the record for a continuous monthly gain in output since January of this year.

The average daily income for 1920 reached the low point in July, the ordinates of the new curve for this year being between 20 and 29 per cent greater than those of 1919.

Electric Heating Declared Impracticable by Canadian Authority

NO PRESENT possibility of using hydro-electricity for heating purposes is seen by C. A. Magrath, formerly Fuel Controller of the Dominion of Canada. For this conclusion Mr. Magrath gives three reasons. First, although the potential capacity of Canada's water powers is enormous, they are insufficient to heat electrically its present homes, to say nothing of future growth, and at the same time to meet the light and power requirements; second, the tremendous cost of the power plant and of the power transforming and transmitting equipment—all of which would of necessity be in use at the same time in cold weather and none of which would be needed for heating in warm weather—puts electric heating beyond practical consideration; third, the proposal to use electrical energy for heating is based upon unsound scientific principles. Electricity should not be wasted; but in the ordinary electric heater the heating element is in the form of resistance, and all the energy is thus a low type.

To heat electrically 20,000 houses each needing 25 hp. at the same time would entail a power plant and transmission installation of 500,000 hp., Mr. Magrath estimates. This is 25 per cent more power than the total capacity of the three large power companies at Niagara Falls, Ontario. If there were so much water power developed and undeveloped that there was no economical use for it, now or prospectively, there might be some excuse for advocating electric heat, the former Fuel Controller concludes; but when ten times as much coal can be saved at every point where electric motors replace steam-driven machines as could be saved by the same amount of energy used for electric heating conservation efforts should be centered on the electric power question—not on the visionary project of electric heating.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Installed Ratings Represented	New England States			Percentage of Installed Ratings Represented	Atlantic States			Percentage of Installed Ratings Represented	North Central States			Percentage of Installed Ratings Represented	South Central States			Percentage of Installed Ratings Represented	Pacific and Mountain States		
			1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase		1919 Thousands	1918 Thousands	Per Cent Increase
REVENUE	Sept.	73	$4,019	$3,536	13.6	53	$11,429	$10,069	13.5	46	$9,671	$8,278	16.6	38	$1,724	$1,488	16.0	63	$5,501	$4,965	10.9
	Oct.	72	4,127	3,453	19.1	53	12,684	10,822	16.9	52	11,401	9,484	20.2	38	1,840	1,519	21.1	62	5,440	4,799	13.9
	Nov.	71	4,432	3,800	16.2	56	14,738	12,761	15.7	44	10,541	8,689	21.2	39	2,063	1,694	21.8	63	5,665	4,983	13.9
	Dec.	73	4,908	4,254	15.1	57	15,926	13,806	15.8	49	11,660	9,833	18.3	44	2,496	2,070	20.0	77	9,135	8,015	14.2
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	5,635	4,718	19.8	59	17,659	14,625	20.9	51	12,885	10,799	19.6	53	3,047	2,538	19.9	75	7,388	6,322	16.1
	Feb.	82	5,354	4,368	22.1	61	17,245	14,343	20.4	55	13,191	10,403	26.0	53	2,949	2,360	24.7	79	7,142	6,028	18.3
	Mar.	82	5,136	4,044	27.0	63	17,696	14,299	23.7	57	13,270	10,469	26.5	54	2,910	2,287	27.8	79	7,143	5,741	24.2
	April	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5,992	19.2
	May	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6,147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July	82	5,007	3,891	28.8	65	16,904	13,438	25.7	57	12,816	9,791	30.7	54	2,764	2,193	26.0	79	9,143	6,959	31.9
	Aug.	82	5,073	4,091	24.0	65	17,013	13,614	24.9	57	13,422	10,125	32.5	54	3,116	2,260	37.8	79	8,479	6,460	31.1
KW.-HR. OUTPUT			1919	1918			1919	1918			1919	1918			1919	1918			1919	1918	
	Sept.	73	153,837	146,209	4.5	53	610,254	610,179	0.1	46	515,519	463,929	11.5	38	58,316	54,838	6.3	63	423,656	420,707	0.5
	Oct.	72	162,859	142,326	14.4	53	694,584	659,859	5.3	67	815,284	709,665	15.3	38	67,155	56,742	18.5	62	435,754	418,412	4.1
	Nov.	71	153,171	140,240	9.2	56	724,667	707,347	2.4	60	686,486	597,855	14.9	39	68,352	59,507	14.7	63	422,812	390,744	8.2
	Dec.	73	180,493	152,304	18.0	58	803,165	733,222	8.9	67	825,313	713,959	15.8	44	88,658	73,728	20.1	77	611,942	597,620	2.5
			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Jan.	78	207,158	159,773	29.8	60	853,057	717,303	19.2	69	841,841	731,758	15.2	56	140,736	117,677	19.9	75	538,304	460,221	16.2
	Feb.	82	187,264	148,103	26.2	62	809,865	672,836	20.1	73	858,939	663,523	29.4	56	130,473	98,098	33.0	79	508,223	403,933	26.1
	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,789	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,895	159,009	20.0	66	881,156	714,494	23.5	74	844,486	703,447	20.0	56	139,254	106,345	31.8	79	626,932	554,957	12.9
	Aug.	82	193,718	170,549	13.5	66	900,510	726,945	24.1	74	891,611	736,753	21.5	56	145,687	110,059	31.9	79	639,215	543,088	17.5

Determining Size of Wire and the Length of Span

No. 6 Wire and a 250-ft. Span Are Found to Be Economical for Most Cases Where Voltage Lies Between 33,000 and 66,000

BY D. F. PARROTT

FOR 33,000-volt to 66,000-volt lines economy in construction and operation can be obtained if No. 6 hard-drawn copper wire is adopted as a minimum size. Any size smaller than this is weak mechanically when used on long spans, and this causes high operating and maintenance costs. To shorten the length of span sufficiently to overcome this mechanical weakness makes construction costs higher in proportion than the difference in cost between the smaller wire and No. 6 wire. No. 6 hard-drawn copper may be safely used where the products obtained by multiplying load and distance values do not exceed the following:

192 kilowatt-miles for	2,300 volts
581 kilowatt-miles for	4,000 volts
1,570 kilowatt-miles for	6,600 volts
6,270 kilowatt-miles for	13,200 volts
17,340 kilowatt-miles for	22,000 volts
38,690 kilowatt-miles for	33,000 volts

These values are used for three-phase, 60-cycle lines operated at 80 per cent power factor and allowable line drop of 10 per cent. For single-phase lines one-half the values given are used. The safe carrying capacity of 60 amp. per wire should not be exceeded when using the kilowatt-mile values. For No. BB iron wire it is advisable to use 20 per cent of the kilowatt-mile values given.

Copper-clad steel wire can be used where the cost of a copper-wire line is in excess of the amount to be expended and is much more economical than the use of iron wire on account of its longer life resulting in lower maintenance costs. It also has a conductivity in terms of copper standard 10 per cent or 20 per cent greater than the conductivity of iron, according to the grade of copper-clad wire used. Copper-clad wire is manufactured in two grades, 30 per cent and 40 per cent of the volume conductivity of solid copper at 20 deg. C. To use the kilowatt-mile values the engineer should take 30 per cent or 40 per cent, according to grade selected, for copper-clad wire. Copper-clad wire is approximately 8 per cent lighter, per unit of volume, than copper wire and has about 15 per cent greater mechanical strength than copper wire for equal cross-section. Comparison of costs of suspension construction for various spans from 250 ft. (76 m.) to 350 ft. (106 m.) showed the following values:

Labor for stringing wire (three No. 4 bare stranded conductors and 0.25-in. (0.6-cm.) Siemens-Martin steel ground wire):

250-ft. span	.94 man-hours per mile
275-ft. span	.92 man-hours per mile
300-ft. span	.90 man-hours per mile
325-ft. span	.88 man-hours per mile
350-ft. span	.86 man-hours per mile
Labor per pole for 250-ft. span:	
Setting only	2.00 man-hours
Tamping	0.75 man-hours
Framing (one the ground)	1.40 man-hours
Hanging insulators	0.67 man-hours
Truck drivers, foremen, inspection, etc.	2.00 man-hours
Commissary and depreciation on camp equipment	1.70 man-hours
Total	8.25 man-hours

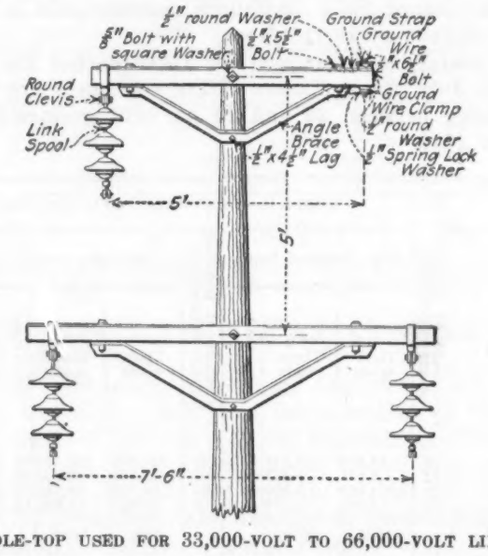
For longer spans this value was increased until 13.9 man-hours was reached corresponding to a 350-ft. (106-m.) span.

In determining the height of the pole required a clearance of 16 ft. (4.9 m.) minimum in the middle of the span is allowed for telephone wires, 6 ft. (1.8 m.) between these telephone wires and the lower high-tension wires, 3½ ft. (1 m.) for the length of suspension insulator string, 5 ft. (2 m.) between cross-arms and 1 ft. (0.3 m.) from the top cross-arm to the top of the pole. The sag allowed was based on a standard table, and the depth of pole setting was 6½ ft. (2 m.) for 45 ft. (14-m.) poles and 50-ft. (15-m.) poles, and 7 ft. (2.1 m.) for 55-ft. (17-m.) poles, in a straight line. Six inches (1.5 cm.) deeper was specified on curves, corners and dead-ends. The material used on the pole head was the same as that shown in the accompanying drawing.

The result of this comparison of cost, assuming the 250 ft. (76 m.) span to be 100 per cent per mile, was:

Span Length	Per Cent Cost of Labor and Material per Mile
250 ft.	100.0
275 ft.	99.8
300 ft.	96.2
325 ft.	97.1
350 ft.	94.6

These figures would appear to favor the long span, but they are based on uniform spans on level ground. No crossings or corners are included. If these were included, the result would probably favor the shorter



POLE-TOP USED FOR 33,000-VOLT TO 66,000-VOLT LINES

spans. Over rough country it is quite probable that the increased cost for long spans would be greater than for short spans. But even under the conditions assumed for this comparison, with level country—that there are no angles or crossings—the cost per mile is nearly constant.

In view of this fact it would seem that the 250-ft. (76-m.) span would be the most desirable, not only because of the better mechanical support but because of better wire separation during storms and in heavy winds, which will very materially cut down maintenance costs and add practically nothing to the construction costs. This information was presented at the Milwaukee State Electrical Association.

Readers' Views and Comments

Non-Recognition of N. E. L. A. Standards Results in Confusion

To the Editor of the ELECTRICAL WORLD:

SIR: Specifications for a standard cross-arm were adopted several years ago by the National Electric Light Association, and since that time a large number of central-station companies have come to recognize the excellence of the design suggested. In view of this fact it seems rather unfortunate that so many jobbers and manufacturers have practically ignored the recommendations of the association and have clung to designs of little or no merit, which do not represent the best thought and practice of the industry. One design of cross-arm quite generally used in many parts of the country a few years ago, and which was perhaps as near a standard as any up to the time of the appearance of the N. E. L. A. specifications, was of 3¼-in. x 4¼-in. section with one foot of length for each pin. That is, four-pin, six-pin and eight-pin arms were respectively 4 ft., 6 ft. and 8 ft. long. The spacing of the pole pins was 16 in. and of the end pins 12 in. The standard N. E. L. A. arm, as is well known, is 3½ in. x 4½ in. in section, with wider pin spacings and the very desirable width of climbing space of 30 in. between pole pins.

Standardization by one company on the basis of the N. E. L. A. specifications led to inquiries of several jobbers for six-pin arms. One firm replied that this arm was "special," was not carried in stock, and that the order could only be filled from the mill, but that it had a very good supply of the "standard" 3¼-in. x 4¼-in. six-pin 6-ft. arms available for immediate shipment. Another firm stated that it could fill the order for fir arms only from the Pacific Coast but had a large stock of the "standard" 3¼-in. x 4¼-in. arms for immediate shipment. A third jobber had a small stock of the desired arms, but the number was so very small that it was of practically no value to the intending purchaser.

Such replies indicate even to the casual observer that those three jobbers were out of touch with the efforts of the association at standardization. It is not improbable that other intending purchasers had been previously discouraged by the difficulty of obtaining the desired material and as a result had accepted the older type of arm. If there really existed no demand for the N. E. L. A. arm, it would appear that the jobbers were overlooking desirable business by not calling to the attention of the central stations in their territory the recommendations of the association.

When the same central station mentioned above ordered a certain type of fused cutouts, which were to be installed on the N. E. L. A. arms (these having been finally secured) they came with hangers for 3¼-in. arms, the manufacturer insisting that this was the width of "standard" arms. Then the hardware manufacturer was approached for transformer cutout clamps and clamp pins, and the information came back that if arms were used larger than the "standard" 3¼-in. x 4¼-in. it would be necessary to supply these items suitable for 4-in. x 5-in. arms, since only two sizes were made. These larger clamps were of necessity accepted, but when used on 3½-in. x 4½-in. arms the bolts were too long and had to be cut off, and at the same time one of the advantages of the clamp pins was lost: *i.e.*, the fibers of the wood could not be bound tightly together to prevent splitting and the rapid disintegration of the arm.

Columbus, Ohio. L. C. PETERMAN.

Resuscitation Through Pain Inflicted by a Blow

To the Editor of the ELECTRICAL WORLD:

SIR: An article written by me and printed in the ELECTRICAL WORLD for Feb. 26, 1916, on page 498, recounted experience and progress since 1912 in regard to resuscitating victims of electric shock through inflicting pain upon them by means of a blow. In a second article from me, printed May 5, 1917, page 840, pictures of the method advocated were given. So great is my faith in it that should all other methods fail I should still practice it. I now wish to state that nine lives have been saved through this means. An account of two of these accidents follows:

On Aug. 25, 1920, George Frickel of Jamaica, city of New York, a lineman in a gang under the foremanship of John Langdon, was shocked while on a pole making a half tap to a 2,200-volt primary wire. He was wearing leather gloves and sustained charred, third-degree burns of both hands which later necessitated the amputation of a finger. The shock rendered him unconscious, and he was held fast to the wire, the deadly current pulsating through his body, until the foreman, who had been around the corner several spans away, ran to his assistance, climbed the pole and knocked him free from the wire. The unconscious man was held at the top of the pole by his safety belt. The foreman then proceeded with resuscitation methods by repeatedly striking the point of the man's jaw, pulling forward his tongue and shouting in his ear. He soon regained consciousness.

Similarly, on Oct. 11, 1920, James McDermott of Richmond Hill, city of New York, a lineman in the same gang, received a shock of the same voltage. He and another lineman, A. C. Maass, had just arrived at the top of a junction pole. McDermott was trying to get in position at the end of the top cross-arm and was standing on the second arm, preparing to pull up the line protectors, when he lost his balance and fell forward, his hands coming in contact with the insulators where the primary wires were dead-ended. Maass gave first aid by repeatedly striking McDermott's jaw and shouting his name in his ear. McDermott recovered while on the pole and was able to descend to the ground with little assistance. He will lose a finger.

As shown by the above cases, it is possible to resuscitate the victim while he is still on the pole by striking the point of the jaw and shouting in the ear. Thus no time is lost. Should that fail, then the method outlined by me previously should be followed. That is, in lowering the man allow him to drop when about three feet from the ground, assigning some one to protect his head from injury, and then repeatedly strike his feet with a heavy stick, a pair of connectors or some blunt instrument. Do not remove the shoes. Strike the soles of the shoes and continue to administer sharp, heavy blows and to shout in the man's ear during the progress of the prone-pressure method.

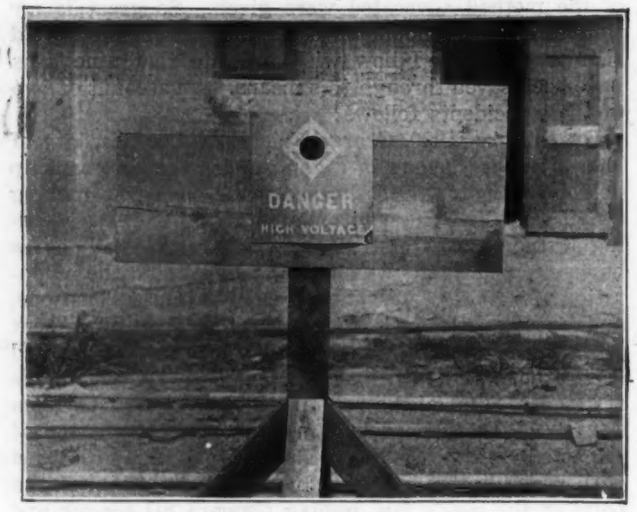
W. P. STRICKLAND,
General Inspector.
New York & Queens Electric Light & Power Company,
Long Island City, N. Y.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A Universal Danger Sign

AN EMBLEM indicating danger wherever it appears is used by the Hydro-Electric Power Commission of Ontario on all its construction and operating work, according to a statement made by W. H. Mulligan before the National Safety Council. One application of the



UNIVERSAL DANGER EMBLEM DESIGNED TO CATCH THE EYE USED ON ALL DANGER SIGNS

emblem is in connection with work on live lines in power plants. The square and diagonal lines are white on a blue field and the center spot is bright red, the combination being especially designed to catch the eye.

Advantages of Colloidal Fuel

ADVANTAGES of "colloidal fuel," which is a blend of oil and coal dust, were enumerated by Dr. C. A. Sheppard before a "fuel symposium" of the American Chemical Society on Sept. 9. Among these advantages are the following:

1. Colloid fuels are liquid and are handled and atomized for combustion like fuel oils.
2. They contain more heat units per gallon than fuel oils.
3. They contain very little moisture and ash.
4. The temperature at which they take fire (flash point) is above 200 deg. Fahr. They are immune from spontaneous combustion.
5. Not only are they vaporless up to high temperature, thus avoiding explosive mixtures with air, but they may be fireproofed by a "water seal" of an inch or more of water, owing to the fact that they are heavier than water.
6. Hence also they will sink if spilled blazing on the surface of water, *i.e.*, they are self-quenching. Their fire risk is as low as anthracite coal and far less than bituminous coal or ordinary fuel oil.
7. They are the most compact fuels known, requiring least storage space.

Colloidal fuels belong to a distinct class of blended fuels ranging from liquid to semi-liquid. They were developed in this country during and subsequent to the last two years of the war. They are composites in which finely divided carbonaceous solids or semi-solids —various kinds of coal—are so suspended in and blended with liquid fuel oils as to form stable and readily atomized fuels. They have been developed for burning with the regular types of atomizing burners using ordinary fuel oils, but have also possibilities for use in internal-combustion engines of the Diesel and semi-Diesel type.

The machinery for compounding these fuels is simple. It consists of a suitable mill for pulverizing coal, coke, etc., storage and blending tanks for the oil bases and mixing kettles for compounding the composite fuel. Little modification in existing types of machinery is necessary, and the process is readily made continuous. The cost of manufacture may be reckoned at approximately $1.50 per ton, inclusive of the "fixateur"—a substance used in small quantity to stabilize the mixture.

Simple Equipment for Making Voltage Tests on Rubber Gloves

EQUIPMENT for making tests on rubber gloves and methods of making these tests, as described by the accident prevention committee at the National Electric Light Association 1920 convention, are outlined in this article.

For obtaining the test voltage the use of a single 10,000-volt transformer rated at from 2 kva. to 5 kva. is preferable, but standard 2,200-volt lighting transformers may be used by connecting them in series on the high-tension side and in parallel on the low-tension side. Since, however, one end of the high-tension circuit is likely to be more or less grounded (through the vessel containing the water in which the glove is suspended), the insulation between primary and secondary of the transformers at the opposite end of the series is likely to be subjected to an excessive stress.

The means employed for raising the voltage gradually should be such that the wave form will not be distorted. The resistance method of controlling the voltage is cheap, and the preferable method is to connect a rheostat in potentiometer style; that is, with the two ends of the rheostat directly across the supply circuit and with one end of the rheostat and the contact arm of the rheostat connected to the low-tension side of the transformer. The rheostat should be able to carry a current about ten times the exciting current of the transformer at maximum voltage.

For measuring high-tension voltage an ordinary voltmeter on the low-tension side of the transformer is entirely satisfactory for practical purposes. The practical method of measuring leakage current through the gloves is to connect an ordinary ammeter in the low-tension circuit of the transformer and note the amount

of the decrease in the current when one glove is disconnected at a time. This decrease divided by the ratio of the transformer gives roughly the current through the glove. This method does not recognize the effect of the phase difference between the exciting current and the current through the gloves, which is not necessary if several gloves are tested at a time.

Gloves are usually tested in groups of any convenient number of from five to fifteen. A convenient method is to suspend each glove in water to within about 1½ in. (3.75 cm.) of the glove top, by means of two spring-clip clothespins attached to the ends of a suitable wire hook hung from a wooden framework. The glove is then filled with water to the same height and potential is applied to the water inside the glove by means of a chain suspended within it. Each glove can be suspended in a separate vessel of water, or all may be suspended in a common vessel. Naturally the vessel will be connected to the grounded end of the high-tension circuit. A single-pole knife switch should be provided in each high-tension circuit so that the leakage current can be measured as indicated above. Moreover, if a glove fails during the test, it can be eliminated.

All of the usual safety precautions pertaining to high-voltage circuits should be observed. The glove rack and the wiring should be properly guarded so that neither the tester nor stragglers can accidentally come in contact with them. The main swicht should be provided with a spring which makes it necessary for the tester to hold it closed. A long insulated pole hook should be used for opening the switches in series with the gloves when measuring leakage currents.

Whatever transformer equipment is used, care should be taken that both the low-tension circuit and the high-tension circuit are thoroughly grounded.

The cost of a special transformer outfit of 5-kva. capacity and for 15,000 volts or 30,000 volts is about $750. An ammeter for leakage current measurements, containers for gloves, switches for leakage current measurements, wire and insulators could be furnished and installed for approximately an additional $150, making the total cost of a complete equipment for testing rubber gloves, transformer oil, etc., about $700 or $750. Where four standard 2,200-volt lighting transformers of about 1-kva. capacity are used the additional cost of a voltage-regulating rheostat, ammeter, voltmeter, etc., including installing, would probably be about $200 to $250.

Drying racks with wooden pins and metal drip pans underneath are convenient. The size of the drying equipment may be somewhat reduced if an electric fan is used to circulate the air heated over a lamp bank. Wooden pins are used on the drying racks, metal pins having been found injurious to the rubber as the pins become hot.

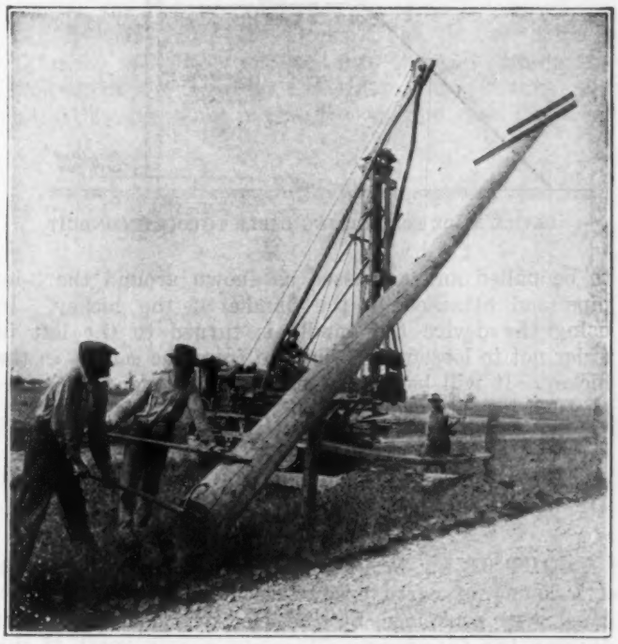
For holding the gloves two cases with locks are provided by one company. One case is for gloves which have successfully passed through the test, have been dried and are ready again for use. The other case contains the gloves which are returned for test. It has a slot in the top to permit gloves to be dropped into it singly. The slot is omitted in the first case so as to prevent the possibility of any returned or defective gloves being dropped in with the good gloves. Electric branding irons are used by some of the companies for placing the necessary company property identification marks on the outside of the gauntlet of the gloves and usually at a point opposite the wrist as well.

Machine Reduces Cost of Hole Digging and Pole Setting 25 per Cent

AT A total cost of $4.72 per pole, 928 poles were set by the boring and setting machine shown in the photograph for lines of the Detroit Edison Company. The poles set were mostly 40-ft. (12-m.) poles, with some "forty-fives" (14 m.) and a few "fifties" (17 m.). The costs include digging the hole, setting the pole, straightening and tamping and moving the machine between pole locations, 176 ft. (54 m.), as well as 20 per cent depreciation. The costs cover only working days, no charges being made on days when repairs were necessary or for moving from one place to another. This cost of $4.72 per pole compares favorably with the average cost of $6.25 for digging and setting by hand.

The gang doing the work consisted of one foreman, one digger driver, one digger operator, three or four ground men, one truck and truck driver. The machine set the 928 poles on five different jobs from March to June under very bad road conditions, mostly on unimproved clay roads, as well as on several miles of private right-of-way on farm lands, necessitating the crossing of ditches. Several of the holes were dug in more than 2 ft. (61 cm.) of water, and quicksand was encountered in several places. It is interesting to note that the machine operates very satisfactorily in quicksand as it gets the pole in place before the sand has a chance to drift into the hole.

This machine is made by the International Earth Boring Machine Company and is equipped with a



MACHINE HAS DUG HOLE AND IS NOW SETTING POLE IN POSITION

Monarch tractor. Two sizes of drills were used, one 24-in. (61-cm.) and one 30-in. (76-cm.), according to the size of pole to be set. The crossarms, braces and insulators, including large pin-type insulators, can be placed on the pole before it is picked up by the machine.

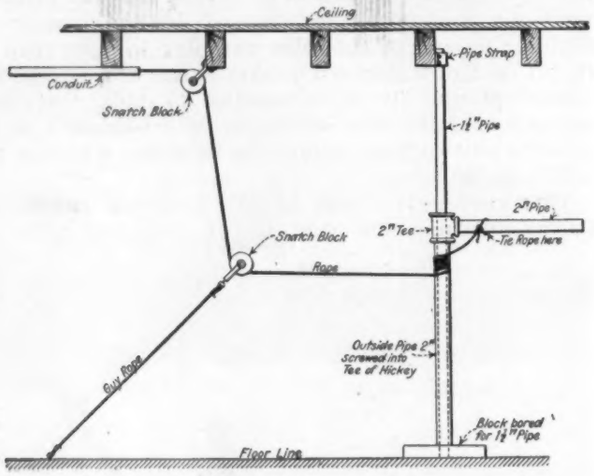
Detroit Edison Company, P. O. REYNEAU,
Detroit, Mich. Assistant Electrical Engineer.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Pulling Cable Without Tackle or Windlass

FOR pulling cable through conduit where a regular tackle or windlass is not available a device such as that shown in the illustration made of a pipe and a hickey has proved very useful to the writer. A long 1½-in. (3.75-cm.) pipe is passed through the tee of a 2-in. (5-cm.) hickey, into which is also screwed a short piece of 3-in. (7.5-cm.) pipe to act as a drum for the rope. The two ends of the smaller pipe are then fastened, the upper end to a beam on the ceiling by means of a pipe strap and the lower end into blocks fastened to the floor. A rope is connected to the cable



DEVICE MADE FOR PULLING CABLE THROUGH CONDUIT

to be pulled and is passed as shown around the 3-in. pipe and attached to the handle of the hickey. In using the device the handle is turned to the left in order not to loosen the 3-in pipe from the screws in the hickey. It will be discovered that a tremendous leverage can be obtained from this device. A. PERTLE.

Chicago, Ill.

Electric Shovel Economical in Excavating Canal

ABOUT 0.8 kw.-hr. per cubic yard (10.4 kw.-hr. per cu.m.) of earth excavated from a 90-ft. (27-m.) canal was consumed by the electric shovels used in digging the Queenstown-Chippawa power canal of the Hydro-Electric Power Commission of Ontario. More than 20,000 cu.yd. (15,280 cu.m.) of earth and rock were removed daily in digging this canal, the major portion of this being accomplished by means of three 8-cu.yd (6.1-cu.m.) electric shovels.

The performance of one shovel by day and by night during seven days is shown by the accompanying record. This Bucyrus shovel is of 300 tons weight, has a 90-ft. boom, uses buckets with a capacity of 5, 6 or 8 cu.yd. (3.8, 4.5 and 6.1 cu.m.), and works on a forty-second to fifty-second cycle of operation. This shovel was working 90 ft. below the surface and loading material on cars approximately 50 ft. (15 m.) above its own base. The test covered a period of seven days, night work being done on only the last two days.

TEST ON ELECTRIC SHOVEL DIGGING 90-FT. CANAL

Total yards, whole test	24,706.5
Total yards, day work only	15,380.0
Total yards, day and night	9,326.5
Kilowatt-hours, whole test	20,436.0
Kilowatt-hours, day work only	12,216.0
Kilowatt-hours, day and night	8,220.0
Kw.-hr. per yard, whole test	0.826
Kw.-hr. per yard, day work only	0.794
Kw.-hr. per yard, day and night	0.882

Storage-Battery Maintenance Systems for Good Operation

TO KEEP a storage battery in good condition some routine system of charging and maintenance must be consistently followed. In such a system the method of charging is probably the most important item. Charging of lead batteries must be at such a rate as not to produce gassing of the electrolyte or a cell temperature in excess of 100 deg. Fahr. (44 deg. C.). Stamped on the name plate of the battery are two charging rates, the lower of which is the finishing rate. The higher figure is given only as a satisfactory rate at which the greater part of the charge may be given under usual conditions. The lower rate or finishing rate is the highest rate at which the battery should be charged after gassing starts, but it is not necessary to decrease the rate below this rate except on equalizing charges.

As a rule the maximum starting rate is equal to the number of ampere-hours out of the battery at the time. For example, a 300-amp.-hr. battery fully discharged could be placed on charge at 300 amp., but the rate would have to taper automatically to keep within the number of ampere-hours out of the battery at any time. This result can be obtained by applying an approximately constant voltage of 2.3 for each cell in the battery.

There are several disadvantages which affect the practicability of this "constant-potential" system. First, the charging rate required at the start of the charge is very high, which calls for high capacity in charging equipment and increases the maximum demand on which the cost of power usually depends. Second, the charging rate, after about 85 per cent of the charge has been put in, falls so low that a long time is required to charge the cell completely unless the voltage is raised to about 2.5 or 2.55 volts per cell. This adjustment beyond the end of the charge has to be made manually, so that the system cannot be considered as automatic. The minimum time of charging a battery in this way is about three and three-quarter hours.

A better scheme in many ways is known as the "modified constant-potential system." This calls for a fairly constant voltage of about 2.6 volts to 2.65 volts per cell. A fixed resistance is inserted in series with the battery and should be of such value as to keep the initial rate within the capacity of the apparatus and also as low as the time requirements will allow. The final rate after the cells start to gas should drop to the finishing rate. The minimum time of charging in this way is about four and one-half hours. This system is very flexible and is the most suitable where the proper voltage can be obtained.

The most satisfactory automatic scheme for cutting off the charge is the ampere-hour meter. The meter is mounted on the truck or tractor in series with the battery at all times, so that charging and discharging current passes through it. After the correct amount of charge has been put in, the meter closes a contact which energizes a circuit breaker to open the charging circuit. The ampere-hour meter also provides a direct indication at all times of the state of charge of the battery.

Once every week the daily charge should be continued at approximately one-half of the finishing rate until all the cells are gassing evenly and freely and until three consecutive readings taken at half-hour intervals of the specific gravity of the pilot cell and battery voltages show no increase.

The battery may be discharged without injury at any rate of current it will deliver. The discharge should be stopped and the battery promptly recharged when the voltage drops to 1.7 volts per cell when delivering the normal service rate stamped on the battery name plate or when the gravity drops over 100 to 125 points for a complete discharge. Thus, if the gravity of a fully charged cell is 1.275, it will at the end of discharge be between 1.175 and 1.150. The battery should not be discharged below this point.

Once every week, or as often as found necessary by experience, pure distilled water should be added. It is necessary at all times to keep the plates and separators covered with electrolyte. Extreme care must be taken in keeping the distilled water free from contamination. The solution in the cells, called electrolyte, is a mixture of especially pure sulphuric acid (oil of vitrol), of 1.835 specific gravity, and pure water. When first installed, the specific gravity of the electrolyte with the battery fully charged should be between 1.270 and 1.280 (temperature corrections are given below). Decreasing specific gravity throughout the battery (when not due to insufficient charging) indicates that sediment is accumulating in the bottom of the jars. An inspection should be made when the specific gravity of the fully charged battery is below 1.250. Never, under any circumstances, should electrolyte of higher than 1.300 specific gravity (corrected for temperature) be poured directly into the cells.

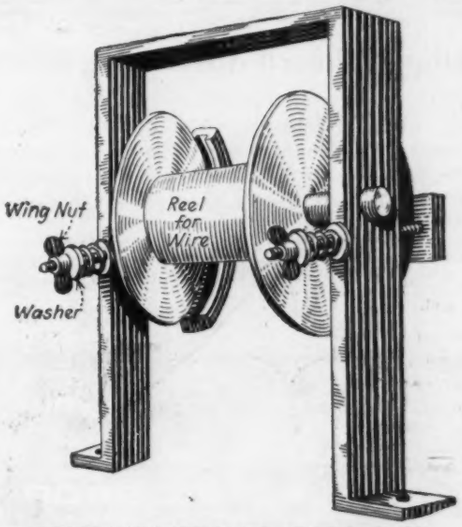
Change in temperature of electrolyte affects the specific gravity, and where the change is considerable it should be allowed for when taking readings as follows: For each three degrees in temperature above 70 deg. Fahr. add one point to the hydrometer reading, and for each three degrees of temperature below 70 deg. Fahr. subtract one point. Example: If the hydrometer reads 1.285 at 100 deg. Fahr., the corrected specific gravity will be 1.275.

ANDERSON PACE.*

*Formerly with Mercury Manufacturing Company, Chicago, Ill.

Rack for Small Wire Reels Which Maintains Proper Tension

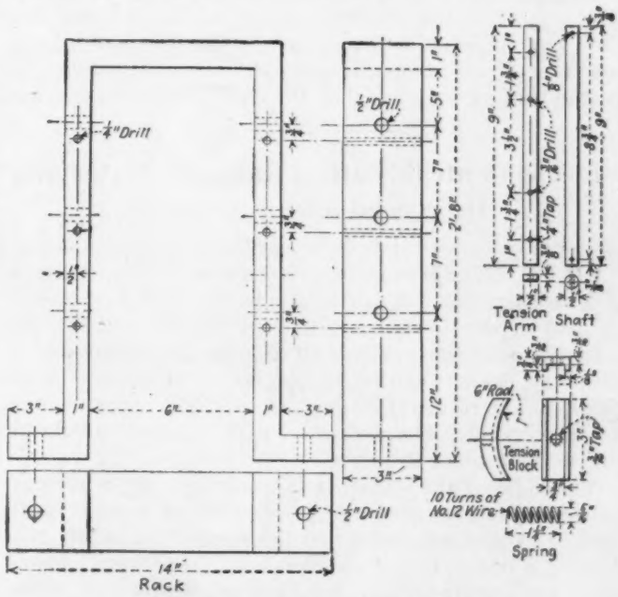
AS THE tension under which wire is drawn from the reels in winding operations affects the ease and speed of working, the rack shown in the illustration was built for holding and controlling reels of wire in sizes from No. 20 to No. 40. The tension is adjusted by



TENSION ON WIRE VARIED BY WING NUTS

springs which control the pressure of blocks against the ends of the reels.

The blocks are attached to a cross arm with machine screws, the ends of the screws being filed flush with the concave surface of the blocks. The tension bolts are threaded and firmly screwed into the two outside holes tapped in the arm, so the bolts will not turn when adjusting the wing nuts. To load the rack the reel is



DETAILS OF RACK FOR WIRE REELS

held so that the ends fit into the grooves of both tension blocks. The shaft is slipped through the reel and the cotter pins replaced so the shaft will be held in place. The reel may be rotated in either direction.

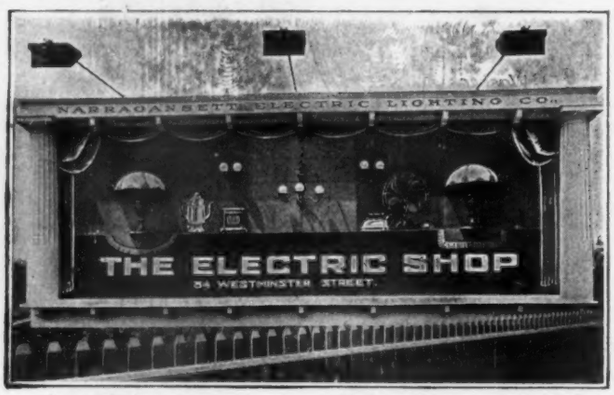
Detroit, Mich. A. C. ROE.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Making Billboard Advertising Realistic

RAISED models of campaign portable lamps two and one-half times the size of the original lamp are shown by the Narragansett Electric Lighting Company, Providence, R. I., in billboard displays as illustrated. The lamps are so accurately made that the two



BAS-RELIEF FIXTURE ADVERTISING AT PROVIDENCE, R. I.

halves shown on the board can be joined together as one complete lamp. In the center of the display are models of other campaign fixtures such as chandeliers and wall brackets. The display is connected to a flasher which lights in turn the portable lamps, center fixtures and then the reflectors at the top. E. R. Davenport, sales manager of the company, considers these signboards to be the best advertising that the company has ever done.

Should Central-Station Rates Be Materially Increased and at Once?

BY KASSANDRA

AN INCREASE in rates so as to give sufficient chance to earn, but not pay in dividends, more than a fair return on the investment will in the end be for the advantage of the public. Of course, the owners of a property cannot expect to receive in dividends more than a fair return for the use of their property and for their skill. The excess on a fair return should be put back into the property.

The logic of the situation can be shown by a numerical example. Suppose the pre-war rates were 8 cents retail to 1 cent wholesale and the return just a fair one. Now, the rise in prices of labor, coal, copper, etc., means that for the same output—that is, neglecting for a moment any decrease in costs due to increase in size and efficiency—it would take today a rate of 16 cents retail and 2 cents wholesale to earn a fair return on what the investment would be when the plant was worn out and replaced by new plant at the present prices.

Increased size and efficiency would very likely in time have brought the 8 cents and 1 cent down to say 6 cents and ¾ cents, if it had not been for the war inflation, and on this basis the 16-cent and 2-cent rate which we would otherwise secure will be only 12 cents and 1½ cents. This indicates that in say twenty years from now, when the central stations have from 90 to 100 per cent of their plant bought at high prices, the rates will be higher than now.

In looking forward to future rates of 12 cents and 1½ cents, as compared with the 8 cents and 1 cent of today, we have three choices:

First, raise the rates at once to the full extent and pay corresponding dividends. This is what the farmer and factory and landlord do, and it means big profits for them such as have been reflected in the prices of industrial common stocks, real estate, etc.

Second, the central station can postpone the raise in rates as long as possible. This will mean that the rates will rise gradually until the total raise has been reached. As a matter of fact, the raise so far has been fairly quick, owing to the rise in coal and labor affecting the cost and rate quicker than the rise in plant investment affects the rates, but the principle is the same; that is, the rates so far have been raised only enough to maintain the earning at a fair return. Again, the essence is that the central station should as a second choice raise its rates each year only just enough to keep the return on the investment a fair one. This is what is going on.

The third choice would be for the central station to raise its rates by enough to earn more than a fair return, but to put the excess over a fair return back into the property as an investment on the part of the public, not as property of the stockholders, who would be entitled only to their fair return in dividends.

It might be said that this would be beneficial to the public generally (or the future customers) at the expense of the present customers. But is not this proper? The fair or economic rate, considering today's costs of material and labor, is 16 cents and 2 cents. The pre-war rates (all of them in principle and the wholesale rates in particular) were just below what the man who makes his own power or gets his service in some other way would have to pay. Hence the present customers who are wired and have service are really profiteering, as compared with their neighbors who do not use central-station power but instead pay the high prices for the competitive service.

If it cost a private plant 1.05 cents in pre-war times and the central station price was 1 cent, this was fair competition. But if it costs the private plant 1½ or 2 cents today while the central-station customers of today are getting the service for 1 cent or 1.1 cents is not this profiteering on the part of the customer? It is, unless the customer who uses central-station power is selling *his* product or services to the public at a less price than the man who operates a plant. Are there

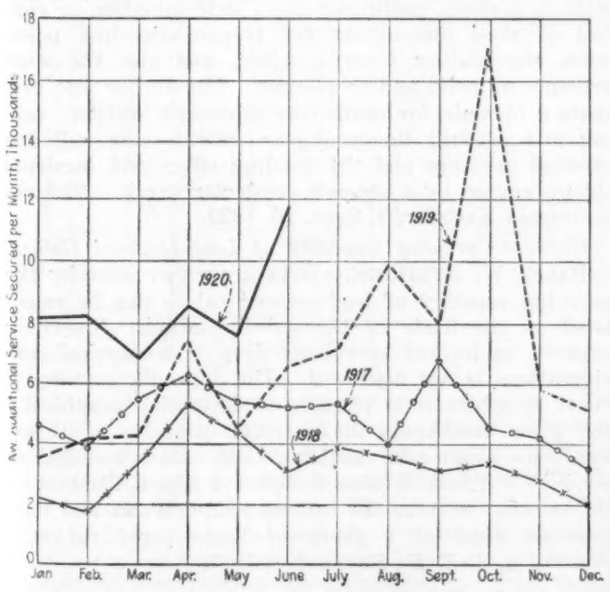
any shoe factories or other users of central-station power who are doing anything other than keeping for themselves the profits they get from the present low rates for electric service, as compared with the profit (or loss) they would have without central-station service?

If central stations generally should until the demand for their service falls off raise rates to a point where they could get turbines and boilers and cables to supply all who want service at the high price the situation would be better all around. In such case the companies that make turbines, cables, etc., could supply the equipment needed, and since the excess earnings over the fair return to the stockholders would go back into the plant, the public as a whole and the future customers would benefit.

Keeping rates down makes present customers none others than profiteers. Raising rates so that the demand for increased facilities and increased service falls again to normal will, unless more than a fair return is actually paid over to the stockholders, benefit the public. This proposition may seem odd to the man who believes that low prices for today are the only thing to be considered, but if we are considering the future the way to get low prices for the future is to have high prices today.

Civic Advantages of Adequate Power Supply

BECAUSE of its ability to supply energy of new electric light, power and industrial heating customers during the past four years the Union Electric Light & Power Company of St. Louis is credited with being largely responsible for the marked increase in the industrial activities of the city. Bankers and business men say that had St. Louis grown during the past decade at the same rate as during the last four years the Missouri metropolis would now rank higher in the census returns.



MONTHLY NET POWER LOAD ADDED TO LINES OF ST. LOUIS COMPANY SINCE 1916, TOTALING 120,000 KW.

When war was declared the St. Louis company had considerable reserve plant capacity and it has since made additions to its generating station. As a result it has been possible for the company to increase the net connected load on its lines by almost 120,000 kw. in three and one-half years. The new power business secured each month is shown by the curve, which represents the net additional load minus all disconnections.

Graphic Illustration of Increased Operating Costs

TO SHOW a comparison of the largely increased cost of coal with the very slightly increased rates for electric service the Pittsfield (Mass.) Electric Company has used some interesting publicity matter, of which the accompanying reproduction is a representative type. As announced in the ELECTRICAL WORLD last week, page 894, the company after Nov. 1 will add an "excess - coal - cost rate" to its present lighting schedules. The excess rate is to be a charge of 0.15 cent per kilowatt-hour for each $1 increase in the cost of coal per net ton above $4.

COST OF COAL PER TON
AVERAGE 'CHARGE' FOR ELECTRIC LIGHT
1916
1917
1918
1919
1920
36,000 Tons of Coal a Year
are burned under our boilers to serve our customers with
Electric Light, Heat and Power
Coal Costs $11.00 per ton today
Coal Cost $4.00 per ton in 1916
INCREASE $7.00 x 36,000 = $252,000.00
Pittsfield Electric Co.

TYPE OF GRAPHIC PUBLICITY

This type of publicity, which shows graphically how the company's operating costs have mounted while its rates for service remained almost stationary, proved very effective in explaining the situation to the public.

California Co-operative Campaign Continues Electrical Homes

REQUESTS from builders, real estate owners and contractors are rapidly coming in to the California Electrical Co-operative Campaign to continue and extend its "electrical home" activities. Builders find that home seekers have an increased desire to build homes having the facilities afforded by many convenient electrical outlets; owners of tracts of land report greatly stimulated sales in the vicinity of the "electrical homes" which have been exhibited to the public, and the contractors and dealers have been called on to provide more outlets and have sold many appliances as a direct result of the exhibits.

Two electrical homes in Los Angeles will be ready for exhibition during November and December, and one in Long Beach during December. Thirty thousand copies of the wiring plans of the homes have been distributed to those visiting the homes and to others. Hundreds of framed copies of these plans are being displayed in the offices of architects, lumber companies, power companies and contractor-dealers. In addition to this a vigorous advertising campaign is being carried on.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Induction Motor Core Losses.—P. L. ALGER and R. EKSERGIAN.—An analysis of core losses in induction motors is the object of the research described in this paper. The authors subdivide the core losses into six elements and point out that only one of the six is ordinarily calculated by designing engineers, with resulting large discrepancies between expectation and fact. The belief is expressed that to calculate other elements approximately is entirely feasible and that such calculations would explain most of the variations in core loss now attributed to imperfections in manufacture. Rational formulas are developed for the losses in the core back of the teeth, which are found to give larger values than the more approximate formulas now in use, and the conclusions are presented in the form of charts giving the correction factors to apply to the usual formulas for all ordinary conditions. A Webb floating dynamometer, which was constructed for the measurement of the extremely small torques due to these core losses, is described, and results on the losses in a smooth-core rotor obtained with it are presented. These results and those obtained by an independent electrical method of testing are compared with the expected values based on the theoretical conclusions previously derived, reasonable agreement being found.—*Journal A. I. E. E.*, October, 1920.

Lamps and Lighting

Effect of Variations in Intensity of Illumination on Functions of Importance to the Working Eye.—C. E. FERREE and GERTRUDE RAND.—Intensity is only one of the lighting factors which influence the functional powers of the eye, the authors say. Their study was conducted only under conditions in which the increase of intensity did not result in the introduction of harmful glare into the field of view. Moreover, much wider ranges of intensity were employed, and the effect on other functions of importance to the working eye has been tested—acuity, power to sustain acuity, speed of discrimination, and speed of adjusting the eye for clear seeing at different distances. The effect of increase of intensity has been measured both on normal eyes and on eyes with small errors in refraction of a type and amount which are of very frequent occurrence even in the corrected eye.—Paper presented before Illuminating Engineering Society, Oct. 18, 1920.

Measurement of Reflection Factors.—C. H. CHARP and W. F. LITTLE.—By the use of a small integrating sphere similar to one described in a recent issue of the ELECTRICAL WORLD by A. H. Taylor a procedure has been worked out whereby the reflection factor of any surface, whether matte or glossy, may be measured by an absolute method. Data obtained by the authors check very closely with those obtained by Taylor, although the two methods were developed independently.—Paper presented before Illuminating Engineering Society, Oct. 18, 1920.

Cooper Hewitt Mercury-Vapor Lamp—I.—L. J. BUTTOLPH.—The first of three articles on the mercury-vapor lamp. This part covers the theory and operation of the lamp.—*General Electric Review*, September, 1920.

Generation, Transmission and Distribution

Theory of the High-Tension Insulator.—SCHWAIGER.—The distributed capacity to ground and the capacity between the insulator and the high-tension conductor, together with the internal capacity between the different parts of the insulator, cause irregularities in voltage distribution, so that certain parts of the insulator during service and test are exposed to greater electrical strain than others. This phenomenon is well known for the case of the suspension insulator chain. The author now establishes artificial schemes to picture the electrical conditions not only in suspension insulators but also in insulators of pin type and in bushings, and presents experimental and theoretical curves showing the voltage distribution under certain simplifying assumptions. The analytical results check fairly well with measurements made on simplified insulator models, without petticoats.—*Elektrotechnik und Maschinenbau*, Sept. 16, 1920.

Steel-Pole Design.—FEUER.—A ready-reference formula is derived, useful for quick determination or control of steel dimensions for transmission-line poles, when the loading force is given, and also the wind pressure on poles and cross-arms. The author also presents a formula for computing cross-arm sections, taking into account line-conductor weight, side pull due to wind pressure and the bending effect and torsional strains caused by a one-side conductor break.—*Elektrotechnische Zeitschrift*, Sept. 16, 1920.

Current-Carrying Capacity of Lead-Covered Cables.—RALPH W. ATKINSON.—Data are given whereby the carrying capacity of lead-covered cables can be calculated on the basis of thermal limitations. Carrying capacity as limited by voltage drop or economical considerations is not discussed. The appendix contains a chart by which it is possible to determine graphically for given conditions the carrying capacity of three-conductor paper and varnished-cloth cables installed in conduits. There is also included a chart illustrating the relation between the various temperatures and temperature rises of a group of lead-covered cables.—*Journal A. I. E. E.*, September, 1920.

Traction

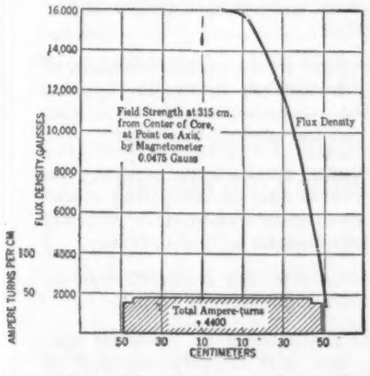
Direct or Alternating Current for Railroad Electrification.—SEEFEHLNER.—There is a decided tendency among certain groups of European engineers to put all direct-current electrification under a common classification as the "American system" and accordingly to

assume that direct current is the only form of supply accepted in America for railroad electrification. This tendency is vigorously opposed by the author in an article referring to the present discussion regarding the choice of a system for Austrian railroad electrification. The author maintains that little stress should be laid on the fact that direct-current supply was chosen for the Chicago, Milwaukee & St. Paul electrification, in view of the peculiar circumstances which affected the choice. First of all, he says, the already existing three-phase transmission lines lifted the burden of transmission-line construction from the backs of the electrification engineers, enabling them to get access to power at any point on the road, so that numerous converting stations could be easily erected all along its length. The author further declares that Swiss and German progress in single-phase traction is very little appreciated in America and that one important reason for choosing direct current for the road mentioned was the lack of time for investigation and trial in a period when any kind of electrification was sure to promote economy.—*Elektrotechnik und Maschinenbau*, Aug. 29, 1920.

Installations, Systems and Appliances

Ward Leonard Control Applied to Heavy Cranes.—H. H. BROUGHTON.—A discussion of the floating cranes which have been provided for the Panama Canal. The subject is considered under three separate groups, namely, (1) power house on the pontoon, (2) motor house on the rotating portion, (3) operator's cabin, also on the rotating portion.—London *Electrician*, Sept. 10, 1920.

External Field Produced by Cylindrical Electromagnet.—CARY T. HUTCHINSON and HAROLD PENDER.—The fundamental problems of cylindrical electromagnets are the determination of the number of ampere turns required to produce a given magnetic field intensity at



FLUX DISTRIBUTION ALONG AXIS OF MAGNET

a considerable distance along the axis of the core for both alternating-current and direct-current excitation and also the disposition of the winding on the core which will give a required magnetizing force with the least number of volt-amperes. This problem is attacked from both an analytical and an experimental point of view. Typical flux distribution curves are given for various arrangements of the exciting coils. Flux values were measured by means of an exploring coil and ballistic galvanometer, while magnetizing force was determined by a magnetometer.—*Journal A. I. E. E.*, September, 1920.

Some Phenomena Observed in Electric Furnace Arcs.—J. KELLEHER.—A study of the causes tending to create variations in the current drawn by the electric furnace, with particular reference to the effect of slags of different compositions upon the current change caused by a given movement of the electrode.—Paper presented before American Electrochemical Society, Sept. 30, 1920.

Units, Measurements and Instruments

Measurement of Casting Temperatures in the Brass Foundry.—JOHN ARNOTT.—After reviewing the various methods available for temperature measurement in castings the author sums up the characteristics a pyrometer should have for this service as follows: (1) It should be accurate within 1 per cent. This means a maximum error of 10 deg. at 1,000 deg. C. (2) It should be capable of use up to 1,300 deg. C., if need be. (3) It should be direct-reading and involve no calculation or correction. (4) It should indicate the temperature of molten metal within at most one minute of immersion. (5) It should be strong and not easily put out of order; at any rate it should permit of easy and cheap repair. (6) It should not be too expensive.—London *Engineering*, Aug. 27, 1920.

Telegraphy, Telephony and Signals

Secret Telephony.—POIRSON.—If the telephonic current passing from a transmitter to a receiver is reversed by a commutator operated at sufficient speed, the arriving current is so distorted that no intelligible sounds are heard in the receiver. If the reversals are made at the rate of a few hundred per second, the voice is very much distorted but the words are still intelligible. Above 1,050 reversals per second, however, it is quite impossible to understand what is said. If at the receiving station there is another commutator, operated in synchronism with the transmitting commutator, the voice current may be restored to more or less normal form. The talk then will be clearly heard in the receiver, while it will be impossible for any eavesdropper to "listen in" on the conversation. The author gives a detailed description of this system of secret telephony, which is said to have come to important use in France during the war and after. The commutators used are of a rotating type and driven by two small shunt motors fed from local storage batteries. The motors are kept in synchronism in the following way: In each motor two taps are brought out from diametrically opposite points on the armature winding and connected to two slip rings, so that each machine is made into a synchronous converter. On the slip-ring side the machines are directly interconnected over a circuit made up of the two telephone wires in parallel and a ground return. Synchronizing currents then will flow over the telephone wires, but when the system is correctly adjusted these currents are very small and do not in the least disturb the conversation.—*Bulletin de la Société Française d'Electriciens*, April, 1920.

Theory of the Triode Oscillator with Intermediate Circuit.—KURT HEEGNER.—If a simple oscillating audion system with tuned plate circuit is inductively coupled to an output circuit containing inductance and capacity, another type of oscillator is obtained which the author characterizes as having an intermediate circuit for transferring the oscillating energy to the output circuit (antenna). The existence of two tuned circuits in the system leads to considerable complication in a discussion of the oscillating characteristics. The problem is treated very comprehensively by the author, and different modes of oscillations are algebraically defined.—*Archiv für Elektrotechnik*, Aug. 8, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

OCTOBER proved to be the record month for this year in the total of stocks and bonds issued by electric light and power companies, these aggregating $38,295,300. This does not include $30,000,000 in bonds issued by the Westinghouse Company at 94¾, to yield 7¾ per cent. Of the public utility issues the largest are $13,000,000 in bonds of the Pennsylvania-Ohio Power & Light Company, $5,420,300 in Commonwealth Edison stock and $5,000,000 in bonds of the Wisconsin Electric Power Company.

A HYDRO-ELECTRIC plant rated at 60,000 kva. is to be constructed near Charlotte, N. C., by the Southern Power Company. This will be the ninth water-power plant to be tied into that company's high-tension network. The plans call for its completion by the summer of 1922.

TO MEET construction expenses resulting from the carrying out of its extensive hydro-electric development, the Pacific Gas & Electric Company plans the sale of $5,000,000 of its first preferred stock. It is the plan of the company to sell the stock over its own counters.

THE FORTIETH anniversary of the founding of the American Society of Mechanical Engineers was celebrated by meetings in New York and about forty other cities, the dominant note struck by the speakers being the opportunities for civic usefulness that lie before the engineer.

ALLEGING that the city of Tacoma, Wash., through an official, indulges in many unfair practices in selling electrical goods and also that a power shortage is threatened by reason of its sale of electrical energy outside the municipality, three electrical dealers of that city have begun injunction proceedings.

CHARGES that Pacific Coast subsidiaries of large electrical manufacturing concerns are operating in restraint of trade are being investigated by the Department of Justice.

FALLING prices and greater ease in the coal market are now reported, while it has thus far been possible to take care of the public utilities under emergency orders, restoration of the assigned privilege is urged.

THE PROPOSED super-power zone in the Southern States is to be studied by the Atlanta Section of the A. I. E. E.

ABOLITION of the Public Utilities Commission of Illinois was indorsed in the election of Len Small as Governor of the state.

NO IMPROVEMENT in the electrical market has been noted except in the Middle West. Price cutting is in process in the Eastern States, but elsewhere prices are being maintained. Stocks are accumulating and better deliveries are helping conditions. The credit situation remains the same, and there is no change reported in the matter of collections. Labor is more plentiful and more efficient. Some electrical manufacturers are making lay-offs. Building remains almost at a standstill. A dull winter followed by a good spring is a favorite prediction.

AN EFFORT is being made by the Indiana Committee on Public Utility Information to have the local chambers of commerce throughout the state pass resolutions calling attention to the vital services rendered by the utilities and asking public co-operation in the form of willingness to pay adequate rates.

INDUCTIVE interference is to be studied from the standpoint of minimizing the susceptibility of communication systems to the inductive fields of power circuits by the N. E. L. A. committee on inductive interference, which will meet in Salt Lake City on Nov. 15.

RESOLUTIONS addressed to the people of Illinois which urge them to safeguard the Public Utilities Commission of that state against attacks made upon it have been adopted by the Central States Group of the Investment Bankers' Association of America.

CAMPAIGN plans to popularize the use of electricity in homes and industries are being pushed by the Electrical League of Cleveland.

WATER-POWER development in its commercial aspects formed the subject of discussion at the Del Monte convention of the Pacific Division of the Electrical Supply Jobbers' Association.

LESS than four months remains in which to establish an accounting system for the Federal Power Commission, and it is thought that only the principles of accounting can be set forth in the time allowed by law and that the details will have to wait.

A FRONTAL attack is to be made upon fundamental problems in insulation research by the insulation committee of the National Research Council. To this end a paid secretary is to be employed.

PLANS for the development of 800,000 hp. by the erection of ten hydro-electric power houses along the Rhine have been approved by the French government. From four to five years is estimated as the time necessary to carry out the project.

EDUCATIONAL courses for industrial electrical men in company time were favored by members of the Chicago Section, A. I. and S. E. E., in discussing the education of steel-mill electricians.

SAMUEL INSULL, speaking before the employees of the Public Service Company of Northern Illinois, dwelt on the importance of making the people realize the serious public results that the crippling of the utility companies would bring about.

TO FURTHER its good-will campaign the publicity department of the National Electric Light Association has prepared four booklets addressed to holders of public utility securities.

PROGRESS in the standardization of washing-machine motors is reported by the manufacturers' committee that has the subject in charge.

CONDUIT production, contrary to the general rule of increasing stocks and slackening demand, is still six to seven months behind orders.

PRICES of wiring material show no sign of an immediate drop.

MANUFACTURERS of schedule material are still actively engaged in production, and many back orders are being filled.

LITTLE or no recession in the demand for power and distribution transformers is reported.

OCTOBER'S close found copper once more below 15 cents, or under the 1906-1913 average of 15¼ cents; but the rapid decline does not appear to have brought about any large market. In the electrical industry manufacturers are stocked with expensive metal and disinclined to buy more.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

To Attack Inductive-Interference Problem from New Angle

THE complete program for the extension of the activities of the National Electric Light Association on the inductive-interference problem will be discussed at the meeting in Salt Lake City on Nov. 15 of the inductive-interference committee of the association.

Heretofore study has been mainly devoted to the disturbing features of inductive field produced by power circuits and the means for their reduction rather than being directed toward minimizing the susceptibility of communication apparatus. It is now planned to develop studies of the susceptibility of communication systems to the inductive fields of power circuits, and also of means for minimizing this susceptibility.

Hydro-Electric Power Survey to Be Made by Southeastern A. I. E. E. Members

THE Atlanta Section of the American Institute of Electrical Engineers at a recent meeting decided to take up during the winter the study of a super-electrical power zone, collaborating with the power committee of the national association and supplementing the work already done by the War Industries Board in its hydro-electric power survey of Georgia, Alabama, Tennessee and the Carolinas. The object is the conservation of coal and future water-power development and interconnection of transmission lines over large areas in the states mentioned. The investigation will require the assistance of the affiliated engineering societies.

Acts that Hurt Utilities Are of Greater Danger to Public, Says Insull

THE serious results sure to spring from action crippling public utilities must be made plain to the public, President Samuel Insull declared in his address to the employees of the Public Service Company of Northern Illinois at the annual meeting of the company N. E. L. A. section on Oct. 25 and 26. "What we need to do," Mr. Insull said, "is to bring home to the people the extremely serious situation in which the citizens of this state will be placed if the various great public utilities do not receive the necessary protection to enable them to build up the necessary credit to obtain the necessary capital with which to develop their business. The communities we serve, as a matter of fact, are infinitely more interested in our success than are the twelve thousand owners of our property, for unless we are able to function and to carry on our business and supply the various industrial, residential and mercantile establishments in these communities with gas and electric service it will be impossible for them to prosper."

In speaking of company affairs Mr. Insull also emphasized the duty of company employees to take an active part in local affairs, saying: "Above all, there is the duty that we owe to the state which affords us protection and gives us an opportunity to gain a livelihood, and that is to do our duty as citizens."

Effort in Indiana to Secure Passage of Resolutions Favorable to Utilities

EVERY public utility in Indiana has received from the state Committee on Public Utility Information a copy of a set of resolutions with the suggestion that the executives of public utilities in every community which has a chamber of commerce take up with that organization the question of securing the adoption of the resolutions. The tentative draft of resolutions sent out called attention to the facts that development of community life and prosperity of public utilities go hand in hand; that good service can be had only by the payment of adequate rates; that increased costs have complicated the problems of utilities, and that the public should co-operate to the extent of being willing to pay fair rates for the service rendered.

These resolutions were based on a resolution recently adopted by the Chamber of Commerce of the Borough of Queens, New York City.

I. C. C. Keeps Utility Emergency Coal Order in Force

WHEN the matter of assigned cars for public utilities was considered by the Interstate Commerce Commission on Nov. 1 that body did not think the public utility coal situation throughout the country sufficiently serious to change service order No. 21 to permit a freer use of priority transportation. Thus far, under the co-operative plan, it has been possible to take care of each of the emergencies which have arisen. George W. Elliott, the secretary of the National Committee on Gas and Electric Service, laid before the commission the pleas of a large number of public utilities for the extension of the assigned-car privilege and pointed out the difficulties which many of them are having in securing deliveries on their contracts. He pointed out that between 80 and 90 per cent of the requirements of the gas and electric companies are covered by contracts. During the week ended Oct. 23, the latest time for which figures are available, deliveries of coal were running from 40 to 50 per cent below daily requirements.

While the addition of 2,000 cars daily to the number available in the Middle West is certain to make for gradual improvement of the situation, it is the belief of Mr. Elliott that it will be several weeks yet before public utilities will be able to build up sufficient reserves to give them the margin of safety that they should have. The minute that the assigned-car privilege was denied the public utilities the temptation again was thrust before the operators of selling coal in the spot market rather than make deliveries at contract prices.

Department of Justice Investigating Trade Practices on Pacific Coast

ON THE complaint of an individual electrical contractor in San Francisco the Department of Justice has made a preliminary investigation of the charge that Western subsidiaries of large electrical manufacturing concerns are operating in restraint of trade. The preliminary investigation failed to disclose any evidence which would justify the department in taking action against the companies concerned, but before dropping the matter the department has decided to make a somewhat more thorough investigation.

Coal Situation Has Become Easier, with Falling Prices

IN AN effort to bring the coal industry back to a more normal condition members of the National Coal Association adopted a program on Oct. 26 at Cleveland to eliminate exorbitant prices and other bad practices in the distribution of bituminous coal. An effort will be made particularly to help the government in its war on those who are profiteering.

Coal prices are rapidly coming down from the unreasonable heights to which they went. Spot bituminous is said to have averaged during October as much as $4 a ton, while mine quotations are around $2 a ton lower than a month ago. It is further held by those conversant with conditions in the coal market that the supply is rapidly becoming easier owing to removal of the Great Lake priority, the decreased industrial demand and greater transportation facilities. More coal, it is stated, is being delivered on contract, and these deliveries will continue to increase.

Investment Bankers Urge Public to Safeguard the Commissions

FOLLOWING a precedent established last spring by the governing body of the entire association, the executive committee of the Central States Group of the Investment Bankers' Association of America, comprising the states of Illinois, Wisconsin, Indiana and Iowa, has adopted resolutions which are commended to the serious consideration of the business men of Illinois urging public support for the Public Utilities Commission of that state. The committee dwells on the fact that the direct investments of many thousands of people and the indirect investments of many more thousands, placed through savings banks and insurance companies, are represented by public utility securities.

The utilities, if properly administered, free from political control and adequately financed, so that they may function to the best possible advantage, are essential to the well-being of every community, the committee declares.

The resolutions were inspired by recent attacks made upon commission regulation of utilities. They reiterate the stand taken by the governing body of the Investment Bankers' Association of America that commission regulation is the modern, progressive, economically scientific method of administering the affairs of public utilities. They urge the people of Illinois to safeguard their present public utilities law in every possible manner in order to promote stability in the investment field and to assure at once proper administration of the affairs of the utilities and proper service by them to the various communities of the state.

Committee of Iowa Section, N. E. L. A., Urges Increased Electric Rates

THROUGH a new committee the Iowa Section of the National Electric Light Association is undertaking the task of convincing the public that increases in electric service rates are needed. Austin Burt of Waterloo is chairman, N. T. Wilcox of Keokuk is vice-chairman. In a letter asking immediate united action Mr. Burt indicates that a 50 per cent increase in rates is necessary to meet increased costs of coal, labor and other items. The committee also contemplates educational work in connection with the question of valuations. It is understood that the State League of Municipalities contemplates presenting drastic measures at the next session of the Legislature. The committee is planning to put before the members of the Legislature the exact condition and needs of the Iowa utilities.

October Record Month in Electric Light and Power Financing

DURING October $38,295,300 in stocks and bonds of electric light and power public utilities was offered to the public. This is the highest total that has been reached in any month so far this year in this class of securities. Another issue of interest to the industry but not included in the above total is the thirty-million-dollar, ten-and-a-half-year bond issue of the Westinghouse Electric & Manufacturing Company, sold at 94¾, to yield 7¾ per cent. Of the public utility financing, $5,420,300 is in stock of the Commonwealth Edison Company, offered to stockholders at par, and the balance of $32,875,000 is in bonds and notes. These are for the most part long-term obligations, with the exception of a six-month issue of the Hagerstown & Frederick Railway Company amounting to $1,050,000, sold at 96½ and yielding 7.85, and $650,000 in five-year notes of the Danville, Champaign & Decatur Railway & Light Company, bearing 8 per cent interest and sold at par. The yield column shows very little change. In four cases it falls below 8 per cent—two thirty-year issues, one twenty-five-year issue and one twenty-year.

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Per Cent Yield	Offered at
Public Service Co. of Northern Illinois	$1,000,000	10-year	Collateral gold notes	8	8	100
Danville, Champaign & Decatur Railway & Light Co.	650,000	5-year	Bond secured convertible gold notes	8	8	100
Commonwealth Edison Co.	5,420,300	.....	Stock	..	..	par
Nebraska Power Co.	1,600,000	30-year, due June 1, 1949	First mortgage gold bonds	6	7.30	84.50
Middle West Utilities	2,500,000	15-year	Secured gold notes	8	8.50	96
Conemaugh Power Co.	2,750,000	10-year	First mortgage gold bonds	8	8.15	99
Kentucky & West Virginia Power Co., Inc.	1,500,000	30-year	First mortgage gold bonds	7	7.75	91.50
Wisconsin Electric Power Co.	5,000,000	25-year	First mortgage sinking fund gold bonds	7.50	7.60	99
Hagerstown & Frederick Ry. Co.	1,050,000	6-month	Collateral trust notes	8	8	100
Pennsylvania-Ohio Power & Light Co.	13,000,000	20-year	First and refunding mortgage gold bonds	7.50	7.85	96.50
San Joaquin Light & Power Corp.	2,625,000	15-year	Convertible collateral trust bonds	8	8	100
Ottawa (Can.) Light, Heat & Power Co.	1,200,000	10-year	First mortgage and collateral trust gold bonds	8	8	100

Prominent Utility Banker Sees Lower Interest Rates for Utilitv Securities

PUBLIC utility securities, especially those of the electric light and power companies, now occupy a much better position than at any time in the past two years, E. W. Niver of Halsey, Stuart & Company, New York City, investment bankers, declared to a representative of the ELECTRICAL WORLD last week. There is an increasing demand for long-term securities, and the general attitude toward the utilities has become more favorable.

"At this time," said Mr. Niver, "banking houses are purchasing long-term securities of high-grade companies to sell on a 7.5 to 8 per cent basis that they could not have considered five months ago owing to market conditions which existed at that time. One of the best indications of the present trend is the increasing demand on the part of investors and dealers for utility securities. While the present market cannot be termed a 'utility market,' there is, nevertheless, a very noticeable inclination on the part of investors to favor this class of security rather than other issues which have been popular during the past two or three years.

"An electric utility which might have had difficulty six months ago in putting out securities at a net cost of 10 to 12 per cent can now obtain money at approximately 9 per cent, and in case of a long-term issue of two or three million dollars the net cost would be somewhat lower. In other words, money is costing 2 to 3 per cent less than last spring, when the utilities could do only short-term financing, for which they paid as high as 13 per cent in some instances.

"There is no one particular reason to which can be assigned the improved demand for the issues of electric utilities. The fact that public service commissions are granting rate increases and inserting coal clauses in contracts has strengthened the position of the companies. Another important factor is the work which the utilities themselves have done in improving public relations by putting their case squarely before the public. The policy of customer ownership has been the best thing that they could have adopted. It has resulted in the sale of millions of dollars' worth of preferred stock widely distributed, and many of these small preferred stockholders are now buying utility bonds.

"With the increasing demand for utility securities," concluded Mr. Niver, "investment bankers are able to give more favorable consideration to new issues, and the natural result, as has already been shown, will be cheaper money for the public utility companies."

Home-Rule Candidate for Governor Wins in Illinois

ABOLITION of the Public Utilities Commission, home rule and 5-cent street-car fares were prominent features in the campaign of Len Small of Kankakee for Governor of Illinois, which resulted in his election Tuesday by a plurality over Senator James Hamilton Lewis estimated at close to 500,000. Small's plurality, while a record for the state, is estimated at about 60 per cent of Senator Harding's for the Presidency. Small's victory gives the so-called City Hall machine of Chicago the control of the state and all municipal taxing bodies except a few small park districts. The effect on the utility situation in the state cannot now be foretold as action must be taken by the State Legislature before the commission can be abolished. It seems, however, that the election result will bring the whole utility controversy in Illinois before the Legislature in an effort either to abolish the commission or greatly to curtail its powers. The Chicago street railway system has so far been the principal bone of contention in the political controversy and for that reason will probably be the first point of attack.

Local Dealers Charge City of Tacoma with Unfair Practices

INJUNCTION proceedings based on a charge that the city of Tacoma, Wash., is exercising a monopoly of the electrical supply business have been filed against the city and I. S. Davisson, Commissioner of the Light Department, by A. Z. Smith, R. A. Wheelock and Roy F. Owen, three local dealers in electrical apparatus. Seven alleged unfair practices are cited by Messrs. Smith, Wheelock and Owen in their complaint. The first complaint alleges that the city sells electrical apparatus and appliances at 5 per cent above cost, whereas any other dealer cannot possibly transact such business at less than 15 per cent above cost. The plaintiffs ask that Commissioner Davisson be enjoined from handling electrical apparatus at rates not compensatory to the city or to the capital employed in the business.

The second complaint is that motors are leased to individuals by the city with an agreement that those leasing them can buy the motors and get credit for all rent paid within twelve months less the interest on the investment. Through this practice, it is alleged, the city reduces the price below actual cost. It is also charged that the city has contracts from one or more large manufacturers for the exclusive handling and sale of their motors, thereby preventing dealers from doing business directly with such manufacturers. Violation of the city charter is charged against Commissioner Davisson because of his alleged practice of purchasing electrical goods without calling for bids. If bids were called for, the complainants declare, the supplies could be purchased more cheaply and the local dealers would have the same opportunity as "favored dealers" to supply the city with goods.

The further charge is made that without regard to statute limitations upon municipal handling of electrical supplies the city has carried on a general business with all comers, whether in or out of the city. As a sixth charge it is declared that the city makes bids unlawfully in competition with all dealers, and still further unfairness is alleged because of the city's practice of keeping leased motors in repair.

In a second and separate cause for action brought by the three dealers they declare that an early shortage of power threatens the residents of the city through Commissioner Davisson's practice of selling power. At the cost of $2,000,000 Tacoma built a hydro-electric generating plant, they declare, with ample capacity to supply the city with light and heat for many years to come. Of late, they say, Commissioner Davisson has exceeded his powers and sold electrical energy to many persons and corporations outside of the city, so that the amount of power available is greatly reduced. Such sales of power, it is alleged, have been made at rates below those charged to the citizens of Tacoma.

Southern Power Company Will Build New 60,000-Kva. Hydro-Electric Plant

PLANS are being prepared by the Southern Power Company for the construction of a new 60,000-kva. water-power plant near Charlotte, N. C. This will be the ninth hydro-electric plant to be tied into that company's system of 2,050 miles of high-voltage transmission lines and will bring the total rating of its hydro-electric and steam stations up to 340,900 kva. This new station will be laid out for four units operating under a head of 85 ft. It will be of the usual type of construction adopted by the Southern Power Company and similar to the Wateree station described in the May 8 issue of the ELECTRICAL WORLD except that the switching structure will be mounted on the roof of the station instead of on a special structure. Outdoor transformers will be used mounted on the side wall of the power-house structure as in the case of the Wateree design. The dam and power house will require about 250,000 yd. of masonry. Preliminary specifications for the four waterwheels have been sent out to the manufacturers. W. S. Lee, vice-president and chief engineer of the Southern Power Company, states that the plans for the new station call for its completion in the summer of 1922.

Attention Called to Tax-Free Feature of Preferred Stock Dividends

THERE is a marked tendency on the part of investors to favor the purchase of public utility issues, and many of the old investors who in normal times were partial to this class of securities are again buying them, said G. A. Hoyt, utility specialist of William A. Read & Company, investment bankers, to a representative of the ELECTRICAL WORLD. This attitude is due to the belief among investors that the utilities have passed their peak of high operating costs and that the general decline of prices will very shortly be reflected in increased net earnings. Another very noticeable feature is the general sentiment that the days of 8 per cent money are about over and investors are already purchasing securities on which the return is considerably under the above figure. Mr. Hoyt pointed out that a recent issue of railroad securities bearing 7 per cent is now selling above par.

Commenting on the type of financing which would be most advantageous to an electric utility, Mr. Hoyt referred to the recent issues of 8 per cent preferred stock by the Cleveland Electric Illuminating Company and Philadelphia Electric Company.

"Aside from the fact that stock is not a mortgage against the property and tends to build up the equity back of the senior securities, many investors would rather purchase preferred stock than bonds and notes," said Mr. Hoyt. "The reason for this is that dividends on stock are free from the federal normal income tax, while this is not the case with bond interest. Even when the 2 per cent normal tax is paid by the issuing company preferred stock dividends show a greater net return. The comparative savings in tax by the purchase of an 8 per cent preferred stock at 100 are indicated in the accompanying table, which shows the net percentage return after payment of all federal tax from an 8 per cent preferred stock contrasted with (1) an 8 per cent bond and (2) an 8 per cent bond free from 2 per cent normal income tax.

"There is no doubt that public utilities will enjoy material benefits from declining prices, and as a consequence they will be able to obtain money at lower rates.

Annual Income	Eight per Cent Preferred Stock	Eight per Cent Bond	Eight per Cent Bond Free from 2 per Cent Normal Tax
$5,000	7.92	7.60	7.76
10,000	7.68	7.04	7.20
20,000	7.28	6.64	6.60
30,000	6.88	6.24	6.40
40,000	6.48	5.84	6.00
50,000	6.08	5.44	5.60
60,000	5.68	5.04	5.20

From the standpoint of the utility the securities issued at this time should carry a callable feature which would enable it to refund an issue when the cost of money makes this advisable. This condition may not be very far in the future."

National Research Council Takes Up Insulation Problems

A FRONTAL attack to be made upon the fundamental problems in insulation research by the insulation committee of the National Research Council, according to a report from Dr. F. B. Jewett, chief engineer of the Western Electric Company, who is chairman of the new committee. At a recent meeting of this committee it was decided to employ a paid secretary whose duties shall include the gathering of all of the known information concerning insulation investigations and the maintenance of records of the committee's activities as the work progresses. The secretary has not yet been appointed.

The committee also decided that it would attack the technical problems by providing some research men in the universities with funds and materials supplied by the industries, under the guidance of the National Research Council.

The scarcity of skilled and trained research men who are capable of attacking these recondite insulation problems is a matter of much concern to the insulation committee. An effort will be made to discover among the post-graduate students and the faculties of the universities men who are able to do this work. The benefits that will ensue to the electrical industry if these problems receive satisfactory solution will in all probability be so great that to measure them in financial terms at this time would be extremely difficult.

Illinois State Electric Association to Meet in Chicago on Dec. 9

THE 1920 convention of the Illinois State Electric Association has been called for Thursday, Dec. 9, at the Hotel La Salle, Chicago. In the morning there will be an address by M. H. Aylesworth, executive manager of the National Electric Light Association, and reports from the committee on modification of electric service rules, R. S. Wallace chairman, and the committee on rules governing rural service, D. W. Snyder chairman. R. D. Hart, president Illinois Electric Metermen's Association, will report on the meter school. In the afternoon two papers will be read, followed by discussions—"The Best Method of Measuring Energy Supplied at Low Power Factor," by E. T. Anderson of the People's Power Company, and "Sale of Securities to Customers," by F. H. Scheel of the Public Service Company of Northern Illinois.

Cleveland Boosts Electrical Service

POPULARIZATION of electricity for home and industrial use is the object of a campaign being undertaken by the Electrical League and affiliated electrical organizations of Cleveland. Plans for a campaign to extend through the coming spring and summer were brought forth at a meeting on Oct. 27 in the headquarters of the league at the Hotel Statler.

Pacific Coast Jobbers Discuss Their Relation to Water Power

AT THE meeting of the Pacific Division of the Electrical Supply Jobbers' Association held at Del Monte, Cal., on Oct. 21 to 23; attention was given to the part that the jobber is to play in the hydro-electric development of the West. A very interesting chart had been prepared by J. M. Morris, sales engineer of the Westinghouse Electric & Manufacturing Company, on which was shown the approximate amount of materials for electrical generation, transmission, distribution and utilization which would be purchased for every kilowatt of hydro-electric energy generated.

A particularly optimistic view was sounded by John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, in a general survey of the hydro-electric situation in the West. A. Emory Wishon, assistant general manager of the San Joaquin Light & Power Corporation, brought out the features of the electrical industry which make it the basic industry of virtually all of the other industries, particularly in the West, and the one which would be the last to feel depressions, and even if they came would feel them to a less degree. The financing of all the immense developments contemplated was discussed by A. N. Kemp, controller of the Southern California Edison Company. The organization of a voluntary speaking bureau to provide speakers for all kinds of organizations was dealt with by Robert Sibley, editor of the *Journal of Electricity*.

A. S. M. E. Celebrates Fortieth Anniversary

THERE was celebrated throughout the country on Friday evening of this week the fortieth anniversary of the founding of the American Society of Mechanical Engineers. At this time the opportunity was taken to emphasize the opportunity of the engineer in public life and his responsibility to society.

The official meeting was held at the Engineering Societies Building in New York, but the meetings held in other cities, about forty in number, had the same broad theme. J. Herbert Case, acting governor Federal Reserve Bank of New York; Samuel Gompers, president American Federation of Labor, and William B. Dickson, vice-president Midvale Steel & Ordnance Company, were the speakers at New York. Telegrams from prominent engineers and industrial leaders were read.

A. W. Berresford, president of the American Institute of Electrical Engineers, in a written contribution to the celebration of the anniversary, pointed out the opportunity afforded to the engineer for a fuller expression of his civic duty. Mr. Berresford said:

"The engineer exists in sufficient numbers to constitute an important, and by reason of his qualifications an influential, part of our people. If he will so associate as to convince the remainder that his expression or action is the actual consensus of his opinion after unprejudiced deliberation, then this expression must and will be given due weight, if for no other reasons than his peculiar qualification and the absence of any possibility of its having been dictated by personal interest."

The A. S. M. E. was organized on April 7, 1880, with eighty present. The society now has 13,000 regular members and 1,000 student members. There are local sections or branches in forty-two industrial centers.

Good-Will Appeal to Holders of Electric Light and Power Securities

ANOTHER part of the printed matter issued in connection with the general good-will campaign which the publicity department of the National Electric Light Association is conducting is now ready for circulation. This is a series of four booklets which are written for the purpose of appealing primarily to holders of electric light and power company securities. They are designed

THREE OF THE INVESTOR'S GOOD-WILL SERIES

to be sent out by electric utilities to all holders of their securities and any others especially interested and by the investment bankers to their customers.

A number of conferences were held with the public securities committee of the Investment Bankers' Association before the series was printed. Already, it is stated, the N. E. L. A. is assured of a circulation of at least 100,000 for each pamphlet. The booklets have attractive covers, and each one bears an appropriate appeal, the respective inscriptions being: "The Power of Co-operation," "The Greater Earning Power of Present-Day Investments," "Where the Dollar Brings Returns," and "The Demand Which Increases Dividends."

Less than Four Months in Which to Establish Water-Power Accounting System

IT IS believed to be physically impossible to comply with the requirements of the water power act in the matter of completing the various accounting tasks which are specified in the law. After an extended search a chief accountant has only recently been found. Less than four months remain in which the Federal Power Commission may do the work. It is believed, however, that the major principles of accounting can be set forth and the details allowed to wait until later. The National Electric Light Association and the National Association of Railway and Public Utilities Commissioners have been appealed to for assistance.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Installation of Vermont Hydro-Electric Corporation.—The new power house of the Vermont Hydro-Electric Corporation near Rutland, known as the Glenn station, has been placed in operation and will generate 13,200 volts, part of which will be stepped up to 44,000 volts and fed into the main transmission line.

China Turns to Electricity.—A recent report from China says that many orders have been given for power and lighting plants for cotton mills and that the demand for lighting plants for cities in the interior is steadily growing. Steam turbines are to the fore where large plants are concerned and are being introduced to some extent in the smaller plants since the rise in the price of crude oil. The Chinese, it is asserted, demand equipment of sterling quality capable of long service.

Rate-Raising Procedure in Oregon.—Public utilities in Oregon cannot advance their rates or charges without a public hearing before the Public Service Commission and an order from that body authorizing the increase, according to an opinion prepared by Attorney-General Brown. "It is apparent that if the rates prescribed by the commission may be abrogated by the utility filing a new schedule the force and effect of the commission's order amounts to little," he asserts. It is Mr. Brown's opinion that as far as rates which have been fixed are concerned the only way to accomplish a change is by a suit in court or by a complaint to the commission on the ground that the rates are unreasonable or by original complaint filed with the commission.

Pittsburgh Stewards Favor Electric Cooking to Reduce Food Prices.—To effect a reduction in food prices in restaurants connected with industrial plants, department stores, clubs and public eating places the Pittsburgh Stewards' Club at a recent meeting favored adoption of electricity for cooking and baking, according to a report in the local press. It was held by the stewards that the installation of electrical appliances in the cooking ranges of restaurants would solve the problem of gas shortage as well as cut down the production cost of meals. It was estimated by officials of the club that more than a thousand restaurants could advantageously make the change. A committee was appointed to arrange for a special meeting to be known as "electrical night." At this session electrical cooking appliances and equipment were to be exhibited.

Massachusetts' Public Utility Legislation.—Under the heading "New Legislation of Especial Interest to Public Utilities, Including Municipalities Owning Lighting Plants," the Massachusetts Department of Public Utilities has just issued a publication containing laws and portions of laws passed by the Legislature of 1920 that fall under the classification of the above title.

Carrying Electricity to French Canada.—A leaflet printed in French by the newly organized Electrical Co-operative Association of the Province of Quebec dwells on the great field for electric expansion in that province, where, the leaflet says, only 850,000 hp. out of a potential hydro-electric supply of 6,000,000 hp. to 8,000,000 hp. has been developed and where only 31 per cent of the population make use of electricity as compared with 79 per cent in California, 91.4 per cent of the people in that state being reached by the distribution systems as against 55 per cent in Quebec. "It is generally admitted," the leaflet says, "that in the isolated districts the sale of appliances and wiring of dwellings encounters a serious obstacle in the fact that good contractor-dealers are rare. The association will be able to render great service to the companies by encouraging contractor-dealers to settle in these places and establish a business."

Rates Still Go Up.—Advanced schedules in lieu of an emergency surcharge have been authorized by the Wisconsin Railroad Commission in Milwaukee, Racine, Kenosha, Cudahy and other places served by the Milwaukee Electric Railway & Light Company. The same commission has authorized the Wisconsin-Minnesota Light & Power Company to increase its rates in all the Wisconsin cities where it operates, these including Eau Claire, Chippewa Falls, La Crosse, Menomonie and about thirty other cities and villages. The Los Angeles Gas & Electric Corporation has been authorized by the Railroad Commission of California to increase its electric rates by 12½ per cent. Other places where charges have been raised are Antigo, Wis.; Haverhill, Mass.; Perry, Juniata, Berks, Lancaster and Chester Counties, Pa.; Tampa, Fla.; Memphis, Tenn.; Urbana, Ill.; Woodstock, Ill., and places in Arkansas served by the transmission lines of the Commonwealth Public Service Company of Fort Smith.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Engineering Society of Akron, Ohio.—On Oct. 27 the electrical section of this society was addressed by R. W. Shenton of the Nela Park laboratories on "The New Era in Lighting."

Rensselaer Student Branch, A. I. E. E.—At the first monthly meeting of the student branch of the A. I. E. E., at Rensselaer Polytechnic Institute, Troy, N. Y., Wynant J. Williams, professor of physics, was elected chairman for the coming year.

New York Section of Welding Society Formed.—The Metropolitan Section of the American Welding Society was organized in New York City, on Oct. 25. Officers are: Chairman, H. A. Currie; first vice-chairman, F. E. La Schaum; second vice-chairman, E. M. T. Rider; treasurer, W. E. Gray, Jr.; secretary, Howard Odiorne.

Iowa Section, N. E. L. A.—New committees for this section have been appointed with the following chairman: Public relations, O. H. Simonds, Dubuque; valuation and rate of return, C. N. Chuff, Davenport; legislation, F. J. Hanlon, Mason City; customer ownership of public utility securities, S. Dows, Cedar Rapids; electric service for farmers, John M. Drabelle, Cedar Rapids; 1921 convention, C. N. Chubb; accounting systems for municipal plants, H. Bellamy, Knoxville; electric service rates, Austin Burt, Waterloo.

Ohio Electric Light Association.—The first meter conference under the auspices of the meter committee of the Ohio Electric Light Association will be held on Nov. 11 at Columbus. The principal subject in the morning session will be a discussion of types, connections and testings of switchboard instruments. In the afternoon session safety measures in customers' installations will be discussed from the standpoint of the underwriters, followed by a general round-table discussion. This is to be an open meeting. S. T. Henton of Akron is chairman.

Coming Meetings of Electrical and Other Technical Societies

Association of Iron and Steel Electrical Engineers—Philadelphia Section, Nov. 6; Cleveland Section, Nov. 8.

National Association of Railway and Public Utilities Commissioners—Washington, Nov. 9.

Society of Naval Architects and Marine Engineers—New York, Nov. 11-12.

American Institute of Electrical Engineers—Chicago Section, Nov. 12. (For program see issue of Oct. 30, page 893.)

Electric Power Club—Hot Springs, Va., Nov. 15-18.

Florida Ice and Public Utilities Association—Miami, Fla., Nov. 15 and 16.

National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19. (For program see issue of Oct. 23, page 845.)

Electrical Supply Jobbers' Association—Cleveland, Nov. 17-19.

American Engineering Council—Washington, Nov. 18-20. (For program see issue of Sept. 25, page 651.)

Jovian Order—St. Louis, Nov. 25 and 26.

American Physical Society—Cleveland, Nov. 27; annual meeting Chicago, Dec. 28-Jan. 1.

A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—Joint meeting, New York, Dec. 3.

Rivers and Harbors Congress—Washington, Dec. 8-10.

Illinois State Electric Association—Chicago, Dec. 8.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Company's Judgment on Effect of Rate Increase Carries Assumption of Correctness.—Except in a clear case, the Department of Public Utilities of Massachusetts has held, the commission ought not to substitute its own judgment for that of the management of a corporation as to whether an increase in rates will increase the revenue in a case where the company is not meeting its operating expenses under the present rates.

Kansas Industrial Court Assumes Jurisdiction of Wage Dispute Between Electric Company and Its Employees.—Declaring that it had jurisdiction over a wage controversy between the Topeka Edison Company and its employees, since the industry concerned is an essential one upon the continual and efficient operation of which the people depend for necessaries and comforts of life, and that it is a matter of public interest that skilled and faithful workers should be always available, the Kansas Court of Industrial Relations proceeded to establish a minimum wage scale of 67½ cents an hour.

Valuation of Street Lamps.—The value of the lamps used in a street lighting system, the Wisconsin Railroad Commission has asserted, must be carried either in the plant account or as material or supplies, although the lamps are subject to constant renewal. A part of the value of a steam-power plant of an electric company must be apportioned to street-lighting service, although a large part of the energy is purchased, in a case where the steam plant is operated over the peak of the load and for a part of the time at least the street lights are burning. An energy consumption of 356 watts for 600-cp. lamps burning 4,000 hours a year and 257 watts for 400-cp. lamps was held not to be excessive.

Air and Water Heating Discouraged.—The Public Utilities Commission of Idaho, in granting authority to the Idaho Power Company to enforce rates for air and water heating which are equivalent to a 30 per cent increase throughout the entire territory of the company, also gave the company permission to refuse to new customers more than 4 kw. connected load for this purpose. The commission declared its conviction that the use of electricity for heating air and water for domestic purposes is not feasible and that the equipment which would be necessary for heating service is needed for power uses. Consideration was also given to the fact that the air and water heating service was installed at a time when there were several companies operating in the field, since consolidated by the Idaho Power Company, and that attempts were made to compete with coal as a heating agent. Though this has been found impracticable, allowance is made for the later increases in coal prices.

Apportionment of Indirect Expense.—The indirect expense of an electric utility supplying service to a street railway should be apportioned, according to a decision of the Missouri Public Service Commission, by ascertaining the ratio of the supplying utility's total indirect expense to direct expense and adding the percentage so obtained to the direct expense chargeable to street-railway service. Compensation allowable a street railway for constructive delivery of energy to the distributing utility may most equitably be based upon the compensation received by the distributing utility for constructive delivery of its energy to the supplying utility.

Additional Revenue to Which Utility Is Entitled Dependent on Several Factors.—In granting increased rates for water and electricity to the Buckhannon Light & Water Company, the West Virginia Public Service Commission said that the amount to which a utility is entitled depends upon the present fair value of its plant for rate making, upon its operating revenue under the existing rate, upon its operating expenses, and to a certain extent upon the kind of service it has been rendering to its patrons. Despite the fact that the service had been subject to justifiable complaint, an increase sufficient to provide a reasonable return should be allowed, the commission held, with the requirement that necessary repairs be made within a reasonable time, inasmuch as the bonded and floating indebtedness of the company virtually equaled the fair value of the property and it would be obliged to go into the money market to procure funds for the necessary betterments.

Suspension Versus Abandonment of Service.—Commenting on the distinction between suspension of service and abandonment of service, the Montana Public Service Commission recently observed: "Suspension of service may be voluntary or involuntary and implies a breach or interruption, more or less temporary, of continuity of service, without any intent to surrender the right to render the service. Abandonment, on the other hand, involves an act of relinquishment of its rights, privileges and franchises by the company without regard to any future possession by itself or any other person but with an intention to divest itself permanently and totally of the right to render the service. The use of these two terms we think most important for clarity of thought in this branch of public utility law." A utility cannot, the commission declared, rely upon confiscation as justifying suspension of service where it has made no application to the commission for an increase in rates.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Utility Cannot Increase Franchise Rates Without Action by Commission.—In Village of Mount Morris vs. Pavilion Natural Gas Company the Supreme Court of New York found that the company, which accepted a fifty-year franchise from the village imposing certain rates, could not exact increased rates from its customers without action by the Public Service Commission pursuant to statute and that it could be enjoined by the village from so doing. (183 N. Y. S. 792.)*

Contracts and Powers of the State.—In affirming the power of the Public Service Commission to increase street-railway rates found inadequate to yield a fair return (People ex rel. City of New York vs. Nixon), the Court of Appeals of New York laid down two general propositions—first, that one whose rights are subject to state restriction cannot remove them from the power of the state by making a contract about them; second, that the obligation of a contract is determined by the law in force when it is made, since existing statutes enter into the terms of a contract by implication. (128 N. E. 245.)

Electric Company Not Negligent in Failing to Provide Barrier Between Substation Bus Wires and Transformer.—By a vote of four to two the Supreme Court of California, in Coughlin vs. Great Western Power Company, reversed the verdict of the lower court and found that the company was not grossly negligent in failing to erect a barrier between its 22,000-volt wires and the substation transformer. Suit was brought because of injury to an operator from electric shock while dusting a dead wire in close proximity to the high-tension conductors. The plaintiff's contention that the current jumped 21 inches to his hand was pronounced scientifically impossible, there being a lightning-arrester gap an inch away and ironwork connected to the ground a foot away from the bus wires which would have intercepted escaping current. Evidence was given to the effect that from motives of economy the company had not erected a barrier, although the dangerous condition had been brought to its attention. On the other hand, the employee admitted "flipping" his duster about in spite of the hazardous nature of the task in which he was employed when he received the shock. (191 Pac. 920.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Edwin S. Carman has been elected president of the American Society of Mechanical Engineers, succeeding Major Fred J. Miller. Mr. Carman was born in Prairie Depot, Ohio, in 1878, and was graduated from the Central Manual Training School of Cleveland, Ohio. After graduation he entered the shop of the Sun Oil Company of Toledo and four years later became associated with the American Machine & Manufacturing Company of Cleveland. He was appointed chief engineer of the company after two years' training in the engineering department, and while with that company he designed a complete line of electric traveling and special forge-shop cranes and hoists, billet rotators, wire-fence machinery and rolling-mill equipment. In 1908 this company was consolidated with the Johnston-Jennings Company of Cleveland, and Mr. Carman was appointed chief engineer and manager of the engineering and machine department. In the same year Mr. Carman was engaged by the Osborn Manufacturing Company of Cleveland, manufacturer and dealer in wire bristle and fiber brushes and wheels, hardware specialties, foundry supplies and equipment, to design, manufacture and build up a complete line of foundry molding machines. In 1913 he became directly associated with the Osborn Manufacturing Company as chief engineer in charge of engineering and manufacturing of the machine division, and in 1916 he was elected a director. He was appointed works manager of both the machine and brush divisions of the company in 1917. He is the author of a treatise on foundry molding machines and pattern equipment and a contributor of papers on the art of machine molding. Mr. Carman has been prominent in the activities of the engineering societies, serving as president of the Cleveland Engineering Society and chairman of the Cleveland Section of the American Society of Mechanical Engineers. He has for a considerable period taken a very active part in the affairs of the last-named society.

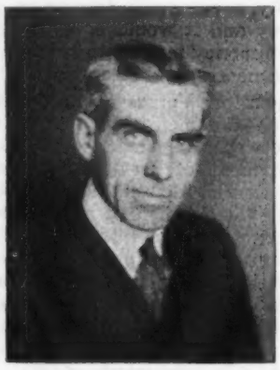
E. S. CARMAN

F. E. Carpenter, heretofore master mechanic of the West plant of the Merchants' Heat & Light Company, Indianapolis, Ind., has been advanced to the position of mechanical engineer.

W. J. Canada, engineering director of the National Electric Light Association, is visiting the Pacific Coast investigating inductive interference problems and getting the viewpoints of utility engineers and managers on the various phases of this problem.

Benjamin F. Thomas has resigned as mechanical engineer for the United Railways of St. Louis to take the position of assistant superintendent of power for the Scullin Steel Company of St. Louis. Mr. Thomas has been with the United Railways for three years. He is a graduate of the Massachusetts Institute of Technology and is a member of the St. Louis Section, A. I. E. E., and the St. Louis Electrical Board of Trade.

E. O. Shreve, manager of the San Francisco office of the General Electric Company, who has been in the East on a business trip, visiting the main offices and plants of the General Electric Company, left New York on his return trip to San Francisco, Friday, Oct. 29.



E. O. SHREVE

Mr. Shreve is one of the most active figures in the electrical industry in San Francisco, particularly in electrical association affairs, having been for two years president of the Electrical Development League in San Francisco, which is the rallying place of those who are ambitious to promote the welfare of the industry.

Prof. Charles F. Scott, chairman of the department of engineering, Yale University, returned on the Finland recently from a three months' sojourn in Italy. Professor Scott had been representing the Western Electric Company in dealing with communication cable location, his associate being L. P. Ferris, formerly assistant engineer in the California inductive interference studies. The particular problem this year was whether it was practicable to run a cable as projected from Milan, Genoa and Turin without interference from railroad and transmission lines, and if not, what precautions should be taken by the telegraph administration and railroad administration or the former alone. Part of the railway, which is in the shape of a Y reaching to the three cities, is already electrically operated and the rest soon will be. As a result of the summer's work a considerable amount of interesting information with reference to inductive interference and three-phase lines under the peculiar Italian conditions was collected, and a modified route which would be free from disturbance with certain precautions was suggested.

PROF. C. F. SCOTT

Otto Snyder, who for the last three years has been general superintendent of distribution for the Adirondack Electric Power Corporation, with headquarters at Glens Falls, N. Y., has recently been made in addition general superintendent of the commercial department of the Adirondack Power & Light Corporation, the new corporation formed by the merger of the Adirondack Electric Power Corporation and the Mohawk Edison interests. This new company does business in Schenectady, Schaghticoke, Amsterdam, East Creek, St. Johnsville, Watervliet, Ballston Spa, Saratoga Springs, Glens Falls, Lake George, Oneida and Canastota. The power load under Mr. Snyder's jurisdiction has been increased to more than 40,000 kw. with annual sales amounting to more than 200,000,000 kw.-hr. Sales of electrical merchandise annually exceed $1,000,000.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Almost No Recession in Demand for Transformers

POWER and distribution transformers continue in good demand. A leading manufacturer is considering increasing his facilities, so great is the faith of the sales force in the future market. Inquiries and orders show little evidence of the business recession apparent in some fields. A representative of the ELECTRICAL WORLD found one of the largest plants in the country working full time a few days ago, with several months' orders on the books. Deliveries are quoted around five months on medium-sized power transformers and three months or less on distribution transformers. Both classes of transformers are in about the same demand.

Prices hold firm and raw material is in good supply, barring a shortage of tank iron and some scarcity in Egyptian cotton. It is doubtful if the shortage of cotton experienced earlier in the year can be made up before January. Large stocks of copper and sheet steel must be worked up by the manufacturers, it is said, before the buying of raw material at reduced prices can be reflected in factory costs. Wages have not been reduced to any extent as yet, nor have layoffs of men been required; in fact, employees are still being taken on in one of the large Eastern factories.

The importance of purchasing transformers with more regard to all-day efficiency is being emphasized in some circles. The high price of coal and the continuous core and line losses involved in scattered installations especially are leading the progressive buyer of transformers to study more carefully than hitherto the engineering characteristics of this class of equipment. In some cases, it is pointed out, the purchaser can afford to pay 15 to 25 per cent more in transformer first cost for higher all-day efficiency.

No Immediate Drop in Wiring Materials Prices Foreseen

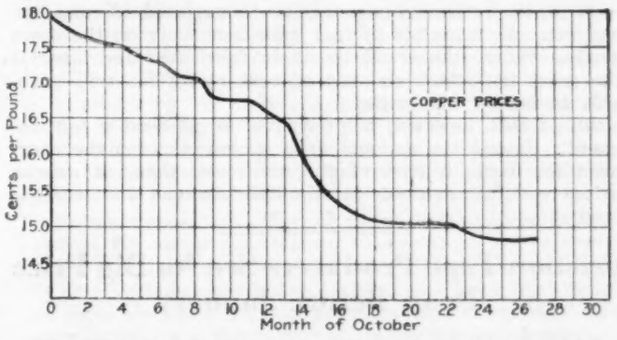
DURING a pre-election visit to a number of wiring-device factories a representative of the ELECTRICAL WORLD found a prevailing belief in the underlying soundness of the industry. A leading sales manager holds that with the election out of the way the prospect of large development in the country's business becomes excellent. Major interest attaches to the course of prices. One company reports a year's supply of raw material on hand; another has a large stock of raw material but one which is somewhat broken. A representative maker of switches for domestic and industrial service states that more business than he can comfortably handle is still coming his way. The point was made with much vigor that until the existing stocks of high-cost raw material are worked off there can be little foundation for any marked reduction in the manufacturer's prices unless labor costs should drop substantially.

The margin of profit is said to be small on this class of material in face of recent cost advances, and while combined failure of the buyer to enter the market would inevitably force prices downward in many lines, the producer of switches and sockets maintains that today's prices are justly supported by the manufacturing conditions. Even if a sharp reduction occurred on wiring devices, for instance, it is urged that the expansion of building operations would not be affected much. Bricks and lumber advanced to a point 500 per cent above the pre-war level, it is pointed out, and these have fallen back to about 200 per cent above 1914 prices. Wiring materials represent less than 1 per cent of the total cost of a modern residence, and current prices are about 100 per cent above pre-war figures. Most observers hold that there is absolutely no ground for somber-tinted forecasts as to the wiring-device business of the coming year, and if reasonable-sized orders soon begin to be placed, perhaps with some flexibility as to price settlements on a fair basis to all concerned at the time of future delivery, this branch of the industry will go forward to prosperity.

Copper Goes Below Pre-War Level in October

WHILE a slight recession has been under way in copper prices since July, the heavy break did not come until late in September and continued through October. As October drew to a close copper had once more gone below 15 cents and at this writing it is half a cent below the 1906-1913 average of 15¼ cents. The large producers had accumulated enormous stocks of metal during a year of small buying and finally found that the pressure of carrying this inactive material was becoming too great.

It is doubtful if the rapid decline has stimulated any large market. In the electrical industry particularly the manufacturers have stocks of expensive metal and are inclined to withhold all buying until their stocks have been disposed of. Indications are that prices will go lower. It is probable, however, that additional cuts will begin to tempt the speculative interests. Consumer demand is entirely lacking and except where absolutely necessary will in all probability not appear until after the first-of-the-year inventory. When the metal reaches 14½ cents the speculators will probably begin to take notice. It is doubtful, however, if this element can force the market higher with a heavy consumer demand.



RAPID DECLINE OF COPPER SHOWS LOSS OF 3¼ CENTS IN FOUR WEEKS

Copper producers seem determined to go as far as is necessary to develop copper buying. Early in 1919 when buying was desired the market was cut to 14½ cents or about 4 cents below the real buying level. The market, however, very quickly adjusted itself and the upward momentum carried it beyond its rightful level for a few months.

The accompanying graph was prepared from the daily quotations of the *Engineering and Mining Journal*. These figures are for electrolytic in large quantities, f.o.b. mine. For consumer cost there should be added from 0.15 cent to 0.25 cent per pound to pay for delivery charges.

Relation of Raw Materials, Labor and Overhead to Falling Prices

LOWER prices of electrical goods, manufacturers state, are dependent upon two factors—costs of raw materials and costs of labor. Certain of the raw materials, such as copper, cotton, steel and wool, have dropped very sharply. Copper, for instance, which is probably the most important of raw materials in the electrical field, is down now to the pre-war level. Cotton has dropped 50 per cent from the peak. It is doubtful, however, if much of this lower price material has yet found its way into finished electrical equipment. In fact, because of large stocks on hand it is doubtful if, in general, any but high-priced materials will be fabricated during the remainder of the year. There seems, therefore, little reason to expect any very marked recessions in price by manufacturers in the immediate future on account of lower prices of raw materials.

On the score of labor there appears to be a steadily decreasing unit cost. It is true that wage rates are as high as ever, but there is almost none of the expensive overtime work. Besides, electrical manufacturers in numerous lines have commented in the past few weeks on the increased production of the individual workman. Where labor charges are a very large part of the unit cost some material reduction in production cost is materially resulting.

There is a question, though, as to how much price relief can be expected from lower labor costs. Production is not so high as it was, and consequently the item of overhead per unit of production is increasing. In other words, where a saving has been effected by increased labor efficiency there is the probability that overhead costs may be an offsetting factor.

Lower prices, however, are bound to come eventually. The order of their coming will probably depend upon the relation of raw-materials cost to total-production cost. Where the raw materials are the most important factor, as in wire, the recession in price can be expected to come the earliest. As a matter of fact wire is already on the down grade. Where the article is finely fabricated and labor is the most important element of cost recessions will probably be longer in coming.

All of this, however, is predicated on at least a fair demand. Should the demand drop so low as to make overhead too large a part of the unit cost, then, of course, prices will fall in order to stimulate demand and increase production.

Friction-Tape Producers See No Big Price Drop Before January

ACCUMULATION of raw material and increased production, coupled with a moderate falling off in orders, have resulted in greatly improved delivery conditions in the friction tape market. A representative manufacturer informed the ELECTRICAL WORLD a few days ago that he could easily handle orders as large as 50,000 lb. a week, quoting seven to ten days' delivery. Factory stocks are not being built up, however, the policy being to supply the jobbers with standard tapes for distribution. The price question is the chief obstacle to larger business. The cost of cotton sheeting has eased off somewhat, but the mills are still heavily loaded with orders and no marked tendency toward sharp declines can be seen in the present price of raw material.

One manufacturer pointed out that no material price reduction on friction tape is to be expected before January. Wages are maintained at the high level attained some time since, and the cost of coal purchased under a five-dollar contract has increased to $18 and $21 per ton in this plant within a few months. A very heavy demand for rubber hose has set in, and tape manufacturers making diversified products are less affected by fluctuations in buying than are producers of a few very limited lines. Tape prices, it is said, are not figured upon the maximum price of cotton sheeting to the manufacturer, and for this reason quite a substantial decrease in raw-material cost would be required to have much effect upon the quotations offered jobbers. Current prices run from 60 to 70 cents per pound. Recent suggestions as to the desirability of using white and gray tapes have borne good fruit, and less than 1 per cent of the tape sold by a large producer is now white. Labor conditions are good, and so far it has not been necessary to lay off employees to any extent in this field. Few cancellations are being received, although in several cases jobbers have shown some sluggishness in ordering on account of the slow movement of tape from their shelves.

Progress in Standardizing Washing-Machine Motors

AT A MEETING of the standardization committee of the Power Club and the American Washing Machine Manufacturers' Association in Chicago, Oct. 25, it was discovered that a great deal of difficulty will be experienced in finding a frame which can be standardized for washing-machine motors without extensive changes in manufacturing processes. As a result of the discussion it is deemed possible to standardize on the shaft diameter and length of extension, though no dimensions were decided on. The meeting was a progress meeting, and further studies are to be carried out. The study is directed at mechanical rather than electrical standardization so that motors of any manufacture can be used with various washing machines without modification of machine or motor mounting designs.

Metal Market Situation

PRODUCERS seem to be holding rather firmly to a 15-cent price for copper delivered over the remainder of this year. Although little or no actual change in the market is evident, their position is apparently stronger because of the greater number of inquiries that are being received. Copper at 15 cents is said to be below the level of producing costs for all but the largest companies. For this reason it is reported that some dealers instead of selling are actually buying copper. Some considerable sales have been made at 15 cents for early delivery. For shipment over January and February of next year slightly higher prices are asked, approximately 15.25 cents being quoted.

The outside market is virtually quoting on a level with producers' prices now, and greater competition is felt among sellers in an effort to liquidate stocks, even at no profit or actual loss. London standard spot copper continues to recede, falling £½ this week to £91 per ton.

The position of tin has again improved, an advance of one-half cent a pound being recorded. Spot zinc declined a fraction of a cent the past week. The scrap-metals market shows no betterment as yet. Foreign arrivals of scrap metal have drugged the market for one thing, and further price drops are recorded this week. Dealers' stocks are very large.

NEW YORK METAL MARKET PRICES

	— October 25 —	— November 25 —
Copper	£ s d	£ s d
London, standard spot	91 10 0	91 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 15.50	Nominal 15.50
Electrolytic	15.00–15.25	15.00
Casting	14.75	14.50
Wire base	17.50–18.00	17.50–18.00
Lead, trust price	7.25	7.25
Antimony	6.37½	6.37½
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	7.50	7.40
Tin	39.50	40.00
Aluminum, 98 to 99 per cent	32.90	32.90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	13.00–13.50	12.00–13.00
Brass, heavy	7.00– 7.50	6.50– 7.00
Brass, light	5.50– 6.00	5.00– 5.50
Lead, heavy	5.50– 5.75	5.25– 5.50
Zinc, old scrap	4.00– 4.50	4.00– 4.50

THE WEEK
IN TRADE

EXCEPT in the Middle West, no improvement has been noticed in the electrical market. Things generally seem to be quiet. In the East prices are cut to produce sales, but elsewhere there seems to be a greater hesitancy to take such a step.

Stocks are piling up, and even in such lines as porcelain, iron conduit and hollow ware better deliveries are beginning to make conditions easier.

No change is seen in the credit or collections situation, nor was any really expected prior to election. The amount of new building keeps contracting. Labor is becoming more efficient and more plentiful. Manufacturers in the electrical line are beginning to lay off men as the demand drops. In some factories this is being postponed by building up factory stocks.

The trade is looking forward to a continued dull winter season, but with a decided change for the better in the spring.

NEW YORK

Business on the whole is just about moving and no more, though exceptions are presented where diligent efforts are resulting in good sales. On steel goods, such as conduit, outlet boxes, lock-nuts and bushings, demand continues strong and the market remains undersupplied. On other material, such as wire, loom, armored cable, etc., efforts are concentrated on keeping down the amount of surplus stock.

A number of cancellations to jobbers are reported, and some price cutting on overstocked lines, especially wire, is being resorted to in an effort to liquidate supplies. The view of the situation expressed by many jobbers is optimistic, however, as in these cases the present market is said to have been foreseen and preparations made to keep down inventories.

Lamps are moving well with some sizes short. The end of the daylight-saving period is expected to boost sales. Heaters are in good demand, but holiday sales of appliances in several instances are not expected to be so large as in other years. Collections have been steadily lengthening and on the whole are very poor at present, with more attention given to pushing accounts.

Porcelain.—A representative jobber quotes 3-in. tubes at $11 per 1,000, two-wire unglazed cleats at $25 per 1,000 and "Nail-it" Knobs at $30 per 1,000 net, in barrel lots. Considerable scarcity exists.

Lamps.—The discontinuance of daylight saving is expected to augment demand, which some jobbers report good and others only fair. General stocks seem good, but certain sizes are frequently short. Some complaint is heard regarding supplies of 40-watt B lamps, 100-watt type C and round-bulb lamps.

Conduit.—Construction work in the metropolitan district has caused demand to hold up strongly. Stocks are low, especially in the small sizes, with shipments very irregular. Quotations range all the way from $85 to $97 per 1,000 ft. for ½-in. black, and from about $110 to $133 per 1,000 ft. for ¾-in. black.

Flexible Armored Conductor.—The local market is almost shot to pieces. Jobbers are having considerable difficulty in keeping down stocks. Cutting of prices prevails, No. 14 two-wire being obtainable as low as $90 per 1,000 ft.

Non-Metallic Flexible Conduit.—Some distributers are overstocked as demand is weak at present. Price cuts are being made. A representative jobber quotes $30 per 1,000 ft. for ½-in. and ⅝-in.

Rubber-Covered Wire.—Although in a few instances good sales are reported as the result of diligent efforts, general demand is weak and prices are soft. Stocks are large though kept within bounds. Reports are current of No. 14 selling as low as $9 per 1,000 ft., and one bona fide quotation of $9.35 in 25,000-ft. lots was made; but the general market still holds about $10 to $10.50 for single-braid. A large distributer has just received word of a drop in base price from 26 cents to 20 cents.

Outlet Boxes.—Considerable scarcity exists under strong demand, and stocks are poor. The discount quoted on galvanized boxes is 25 per cent and on black 30 per cent.

Lamp Cord.—The price of silk cord ranges from $48 to $50 per 1,000 ft., while cotton cord, light, is quoted at from $32 to $35, and heavy from $37 to $40 per 1,000 ft. Demand is only fair.

Heaters.—Sales are fairly heavy, one jobber selling more than 3,000 last month. Shipments are coming through nicely, but the size of stocks varies greatly.

Heating Appliances.—Electric irons are plentiful, but some jobbers are short of percolators and heating pads, while one large company is overstocked on the whole line. Demand varies from fair to excellent, but the view is expressed in several quarters that Christmas sales will not be up to normal. Shipments of goods are on a schedule basis.

Lock-nuts, Washers and Bushings.—The market is undersupplied. Demand is reported good and stocks are not large.

Pole-Line Hardware.—The Electric Service Supplies Company increased the price of certain galvanized insulator pins 5 per cent in the latter part of October owing to the cost of malleable iron. On some types of cross-arm braces, etc., the company reduced prices 5 per cent at the same time.

CHICAGO

A decided feeling of optimism is noted throughout the industry this week owing to the fact that the gradual shrinking of business seems to have been checked and that inquiries in most lines show a decided increase. The campaign of education as to the sound foundation of present prices in the industry being carried on by jobbers and manufacturers is bearing fruit, and the feeling is general that the worst of the slump has been reached.

Inquiries by the railroads, particularly for power apparatus, are coming in in gratifying numbers. Talk of wheat strikes has complicated the collection problem in the agricultural districts, but no serious condition has arisen. Some difficulty is reported in financing farm-power lines.

Power Apparatus.—Marked increase in the volume of inquiries for large size motors—above 5 hp.—is noted this week, particularly from railroads. Manufacturers are able to ship various sizes above 15 hp. from stock, and delivery on those sizes not in stock ranges around ninety days. Much speculation as to the future of prices is heard, but no indications of a cut can be seen.

Transformers.—A sharp drop in transformer demand for farm-power use has been felt. The attitude of the farmer, who seems to have decided to sit tight and await the future of prices, has served to delay several rural-power distribution projects and to cause some buyers of large lots of transformers to request delayed delivery. Business in large-size indoor transformers remains about normal.

Copper Wire.—The most recent quotation on No. 8 bare wire is $24 per 100 lb. in 200-lb. lots, and that on No. 6 is $23. Weatherproof is now $31 per 100 lb. for No. 12 and $29 per 100 lb. for No. 10, triple-braid solid, in 500-lb. quantities. Demand remains normal and supply prompt.

Galvanized Strand.—Factory conditions seem to be improving as deliveries are now promised in thirty to sixty days on all sizes. Demand is apparently abnormal, but the difficulty in obtaining stock is probably causing some duplication of orders. Orders are being accepted on an open price basis only.

Tools.—Supply of lineman's tools is steadily improving. Klein tools are promised now in from thirty to sixty days, whereas two months ago no definite promise could be made. Orders continue to be placed in large volume at date of shipment price.

Steel-Taped Cable.—Trouble in obtaining steel tape for armoring has delayed production to such an extent that deliveries are uncertain. Demand from municipalities remains strong and prices are still held open awaiting developments.

Heating Appliances.—Retail sales show some increase in the past week, and inquiries for Christmas trade are very numerous, giving the impression that holiday business is going to be good. Jobbers are in position to supply all demand, and prices are firm.

Washing Machines.—A feeling of optimism is felt this week throughout the industry, based on the fact that retail sales are improving. A new inclosed-type machine is being marketed at a retail price of $225. Inquiry for the highest class machines for Christmas trade is lively with all dealers.

BOSTON

Business continued uneven at the close of last week, with slackness in some lines and vigorous activity in others. Boston jobbers are still handling a good volume of trade, although the demand for fast-moving supplies has quieted down decidedly. In southern New England distributers report rather dull conditions, accompanied by curtailment in manufacturing circles. Where overstocks exist prices are relatively weak, and wire sagged off sharply last week to lower levels than for some time. Only a small amount of curtailment has thus far been observed in New England electrical factories and very little laying off of labor. Improved production is widely noted among employees. Despite uncertainties as to prices, opinion is widely prevalent that the outlook for business is excellent. Collections are fair, even in localities where the volume of trade is considerably reduced. Stocks are running overfull in many lines, and manufacturers report many requests for postponed shipments, with some cancellations also. Deliveries are greatly improved in most lines, although rigid conduit and small motors are still far behind. In many quarters there has been marking of time until the election ceased to be an issue.

Wire.—Weatherproof wire dropped to a 23-cent base last week, and local stocks of rubber-covered wire sold down around $9 to $9.50 per 1,000 ft. in 5,000-ft. lots of No. 14, one sale as low as $8 being reported from Connecticut. Bare wire fell to 18½ to 19 cents base. Demand is only fair.

Flexible Armored Conductor.—This material is in good supply, with current quotations around $85 per 1,000 ft. in 5,000-ft. lots, single-strip, No. 14. Not much change in demand is noted.

Motors.—Shipments are improving on small motors as manufacturing facilities gradually begin to overtake the demand. In the textile and leather industries a good deal of reconstruction of motor drives is under way.

Fuses.—A brisk demand is noted and one of the leading manufacturers reports inability to fill orders with satisfactory speed. Reductions in the price of brass have not yet been reflected in fuse prices, and stocks are none too large.

Sockets.—Jobbers are buying little schedule material just now, and many cancellations are being received by manufacturers. Improved demand is anticipated before long, however. Prices are steady, with the following typical case-lot quotations: Pulls 50 cents net, keys 28 cents, and keyless sockets 26 cents.

Rigid Conduit.—Pipe is coming into New England in a little better volume. A relaxation of prices is expected in some quarters, but speaking generally, stocks are not anywhere near normal.

Lightning Arresters.—Business is brisk, and it is difficult to obtain shipments from manufacturers.

Oil Circuit Breakers.—Larger sizes are handicapped on delivery on account of the shortage of steel castings. Orders are coming in well and both central-station and industrial improvements are responsible.

Radiators.—Stocks are still equal to the demand, owing largely to long-continued warm weather. Retail displays of radiant heaters are exceptionally extensive. Prices are steady.

Appliances.—This trade holds up well in the main, but manufacturers are not quite so hard pushed in some lines. Stocks of washers and cleaners are large, and evidences are appearing that recent shortages in hollow ware are being made up. Generally, prices are firm, but in the retail trade some cuts are encountered here and there.

ATLANTA

A slight increase in the price of cotton during the past few days has lent a more optimistic tone to the rural districts and will, in all probability, stimulate ginning and marketing of the product. This should help collections. Demand for building material is light, and while electrical jobbers report that supplies of electrical material required in this line continue to move satisfactorily there has been a considerable falling off in the number of new orders. Hardware-store sales in the Sixth Federal Reserve District show an increase in all states, except Louisiana and Florida, where reductions of 7½ per cent are reported. This condition is similar to that existing in the electrical jobbing trade. Building permits of eighteen principal Southern cities for September number 1,903, valued at $3,839,397, an increase of $346,000 over September, 1919.

Stocks of materials continue to be received in growing quantities, and at the recent meeting of the Southern jobbers it developed that they were in a fair way to find themselves overstocked in loom, wire, key sockets and socket specialties.

Wire.—A sharp break occurred in the market on Oct. 28, the price of rubber-covered falling to 20 cents and weatherproof to 22-cent base. Large stocks are reported throughout the territory, but orders are only fairly satisfactory.

Fans.—New fan prices have just been announced, desk and bracket fans being increased from 5 per cent to 10 per cent and ceiling fans from 10 per cent to 20 per cent over last year. The ceiling-fan business in this section continues fair, as orders from the southern portion of the territory are received throughout the winter months. Stocks are reported in fair condition.

Christmas Specialties.—Jobbers report retailers placing satisfactory orders for nearly all lines of Christmas goods. Hollow ware, which is beginning to come in in limited quantities, is reported quite popular. Toys are also in considerable demand.

Sewing Machines.—The dullness reported in this line several months back continues. Some jobbers express the opinion that this specialty will be handled in future largely by the regular sewing-machine trade. All jobbers have good stocks on hand at present and are not placing new orders.

Cross-Arms.—Fair stocks of cross-arms are on hand and, like all other pole-line material, are moving satisfactorily, fir arms of the standard type being the most popular. Prices, lots less than 1,000 linear feet, two-pin, 3-ft., 79 cents; four-pin, 4-ft., $1.05; six-pin, 6-ft., $1.59. Pins, 1¼ in. x 8 in., $3.50 per 100; 1½ in. x 9 in., $6 per 100.

Porcelain.—A slight improvement in the supply of porcelain is to be noted, one of the largest jobbers reporting that a generous supply of knobs, tubes and cleats has recently been received. Prices: "Nail-it" knobs, $4.65 per 100; ⅝-in. x 4-in. tubes, standard packages, $1.77 per 100; cleats, two-wire, unglazed, $2.50 per 100.

ST. LOUIS

The electrical market here has been quieter this week than last week, some jobbers reporting sales almost as small as those of their poorest week in September. The October volume of business will measure up well, however, with that of the preceding month, which was quiet also.

Some readjustment has already taken place in the St. Louis market, copper wire being considerably weaker than it was three weeks ago. The sentiment is general that loom and porcelain are due to follow, practically all St. Louis jobbers having big stocks of both. However, 15 per cent is the maximum decline expected on most articles, which compares very favorably with the cut of from 35 to 50

per cent that is now prevailing in the textile market here.

Stocks are in very good condition on most items and overstocks of others are accumulating because of cancellations and good deliveries from manufacturers. Retail demand is very light, and utilities and industries are coming very rapidly to the point where they are buying only for maintenance work and to finish installations started some time ago. Jobbers report that the buying even for maintenance work is closer than it was a year ago.

Stamped-Steel Boxes.—Stocks are spotty, some jobbers reporting them scarce and hard to get, others saying they have fair stocks and can get fair deliveries from manufacturers. The demand is good considering the supply, as there is still a fair amount of rewiring going in.

Rigid Conduit.—Stocks of ¾-in. black iron conduit show signs of improvement after being virtually off the market for several weeks. It is still hard to obtain, however, and the ½-in. size is extremely scarce. Larger sizes are easy, but the small galvanized conduit is short. Prices are steady at $80 per 1,000 ft. of ½-in. in lots of 5,000 ft. or more and $110 per 1,000 ft. of ¾-in. in lots of the same size. The 1-in. black is quoted at $148 per 1,000 ft.

Motors.—The motor situation shows very little change. Fractional-horsepower motors are plentiful with a slow demand. Large motors are fairly easy also, with normal deliveries. Sizes between 2 hp. and 20 hp. are harder to get. There is a strong demand being manifested for small industrial installations in the oil fields and in the rice-growing sections of the South.

Insulators.—Both 33,000-volt and 6,600-volt porcelain insulators remain scarce with a steady demand. Some jobbers report public utilities ordering ahead for extensions contemplated for next spring. Prices are stationary.

Washing Machines.—Some jobbers report better demand than others, but on the whole the last two months have seen a very slow business. Stocks are large but prices are remaining firm.

Conduit Fittings.—These are moving slowly and there are large stocks in jobbers' hands. Prices are steady.

Irons.—Stocks here are spotty, but jobbers can get immediate delivery from manufacturers to supply all their needs. Dealers report a fair demand.

Holiday Trade.—From present indications this will be considerably smaller than last year, unless there is an eleventh-hour rush by dealers to fill out their stocks. Some jobbers say that if the volume of holiday trade is 75 per cent of what it was last year they will be satisfied.

SALT LAKE CITY—DENVER

This week records little if any change in the status of the electrical trade. Neither dealers nor jobbers can see very far ahead with reassuring certainty. They are trying to play the game safely by meeting the demands as they arise and refraining from speculative plunging. Wholesale houses are trying hard to unload excessive stocks, while dealers seem to be risking losses on price advances rather than take on merchandise for which there is no demand in sight. Dealers that have been consistent and persistent advertisers are noting a steady increase in their volume of trade. A merchant typical of this class reports a 9 per cent increase in October over September. He admits, however, that vigorous selling methods are required.

Demonstrating in the homes of prospective buyers is proving an effective selling method and is being done very extensively by dealers. A liberal credit arrangement is often the clinching argument in the sale of such electrical utilities as vacuum cleaners and washers. A decided pick-up in trade is looked for at holiday time, and considerable preparation is being made accordingly. During the past month dealers have noted that the retail trade has fluctuated with the changing spells of fair and stormy weather. Sunny days bring the shoppers out, while storm has a very depressing effect on business. Many electrical workers are having to seek employment in various other fields on account of inactivity in all lines of building. Merchandise is abundant in all commercial lines, while electrical products required in building continue short.

SEATTLE—PORTLAND

Electrical supplies in the Seattle and Puget Sound territory are moving as well as could reasonably be expected. Stocks continue to improve in most lines, with the exception of motors, rigid conduit and porcelain. Construction work during the past week showed further decrease, although authorities insist that building prospects were never brighter. Material, with the exception of cement, is fairly plentiful, and the supply of building labor far exceeds the demand. The disorganization subsequent to the adoption of the open-shop policy by master builders apparently has passed.

Portland manufacturers report that while business is active, it is appreciably slower than it has been. Stocks there are not improving materially. A shipment of black iron conduit has been received which puts that line in excellent shape for a time. The sale of household appliances is showing further improvement as is also the lamp movement. Price adjustments due to the increased freight rates have practically all been made. These freight increases have in many instances been absorbed by the jobbers, in most cases on broken-package quantities, but in standard quantities in some cases a slight additional charge has been made. Washing machines have had a slight increase because of freight. On heating appliances, however, there has been no additional charge. The credit condition continues to be in bad shape. Contracting business in general is satisfactory, although some contractors have very little to do. Some dealers appear somewhat pessimistic, but in general those who hustle find all they can take care of.

Holiday Toys.—Seattle jobbers have not accumulated or ordered very large stocks, as the movement of toys in past years did not warrant the step.

Portable Lamps.—In expectation of a heavy holiday demand jobbers placed fairly large orders and these are beginning to arrive. Silk shades have been stocked more heavily than last year. Retailers' orders are just beginning to come in, and from indications sales will exceed those of former years.

Water Heaters.—These are selling better than was originally expected. Stocks are in good shape and replacements are coming through satisfactorily. Prices, contrary to expectations, have not advanced materially.

Electric Ironers.—Propaganda by jobbers and window demonstrations by dealers are stimulating sales. The field has not been much worked in this section, but the trade is beginning to realize the possibilities in this line. The price is all that is holding down the volume.

Schedule Material.—In spite of decreasing residence construction demand is fairly active for repair and extension work. Prices are steady and stocks are in fair condition.

SAN FRANCISCO

Light buying is the rule, and examination of jobbers' orders reveals the fact that unit packages and coil lots predominate. Early rains have encouraged the belief that this winter will be the long-awaited and hoped-for wet winter. An unusually hot spell has put the necessary finishing touches on the fall crops.

Rubber-Covered Wire.—The present price on No. 14 single-braid solid is $12 per 1,000 ft. in 5,000-ft. lots, in which most of the sales are made. Local stocks are excellent, not only in the standard house-wiring sizes but also in unusual strandings and braidings.

Vacuum Cleaners.—This is again the most popular household device, good sales being made through the practice of assigning active salesmen on each make to aid the dealer in his efforts. These flying circuses are accomplishing results now, although whether such a method of selling produces permanent effects is yet to be seen.

Lamps.—Stocks are good and factory deliveries prompt. The approach of shorter daylight periods has produced increased buying and accentuated the already keen competition for new and renewed contracts.

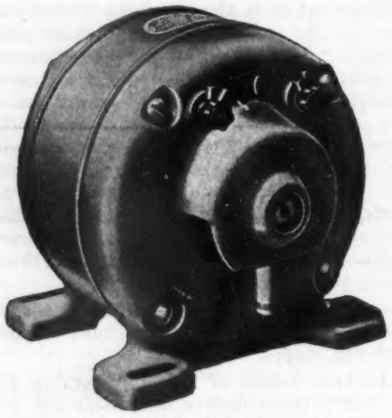
Reflectors.—Industrial lighting lines are depleted by the demand due to propaganda in support of better illumination.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Small Alternating-Current Motors

A line of "Twin-R" fractional-horsepower alternating-current motors for household and industrial applications



HAS SPLASHPROOF BEARINGS

has been put on the market by the American Radio & Research Corporation, Park Row Building, New York City. Production is concentrated for the present on ⅛-hp., ¼-hp. and ½-hp. sizes. They are wound for 110 volts or 220 volts.

Transportable Power Plant

A mobile power unit for driving small portable conveyors used in mining has been designed by the New York

COMPLETE GENERATING PLANT MAY BE HAULED AROUND

Engineering Company, 2 Rector Street, New York. This "Ludlum Dynamobile" consists of a Ludlum water-tube marine boiler, a steam turbo-generator unit, switchboard, boiler-feed pump, feed-water heater, condenser and, if desired, a superheater—all mounted on a steel frame carried on wheels. The outfit can be furnished for burning any kind of fuel. The combustion chamber is surrounded by the water-filled steam generating parts of the boiler. The sizes vary from 10 kw. to 200 kw.

Flat-Coil Dial Resistance Boxes

The dial decade resistance boxes recently brought out by the Pyrolectric Instrument Company, 636 East State Street, Trenton, N. J., are made up of ten flat coils arranged one above the other on a brass core which is held by two bakelite ends. These flat coils are impregnated with moisture-proof wax. The dials are made with a resistance which can be varied in ten steps. The total resistance is 1 ohm in the smallest size and 1,000 ohms in the largest. Units are made to contain from one to five dials in one case.

Magnetic Separator

A separator for removing iron from non-magnetic material is being manufactured by the Butte Electric & Manufacturing Company, 534 Folsom Street, San Francisco, Cal. The material is passed over an electrically magnetized drum on a conveyor belt, the non-magnetic material falling by gravity into a suitable receiver while the magnetic material is held against the belt until it leaves the drum, at which time it drops off and may be collected in another receiver. The drum comes regularly in sizes of 12 in. in diameter and from 14 in. to 24 in. in length.

Notes on Recent Appliances

Washing Machine

A washing machine has been placed on the market by the Vulcan Manufacturing Company, 1511 Cypress Street, Kansas City, Mo.

Cut-Out and Switch Box

A metal cabinet for inclosing cut-outs and switches has been placed on the market by the United Metal Box Company, 514 West Forty-sixth Street, New York City.

Flashlight

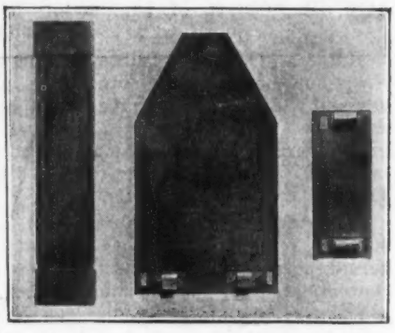
A flashlight with a luminous button has been placed on the market by the United States Electric Manufacturing Company, 300 West Thirty-seventh Street, New York City.

Extension Holds Cord Clear of Fixture

A switch extension for bringing the pendent switch or the pull switch clear of the lighting fixture has just been developed by the St. Louis Brass Manufacturing Company, St. Louis, Mo. The extension is in the form of an arm, made of steel, zinc-plated and rust-proof, to be attached to the junction box or screwed to the ceiling.

Heating Units for Irons, Radiators, Etc.

Heating units for use in radiators, flatirons, water vessels, etc., have been developed by the Prometheus Electric Company, 511 West Forty-second

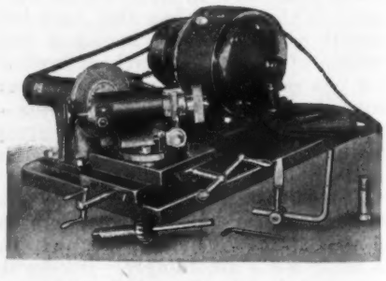


HEATING UNITS FOR APPLIANCES

Street, New York City. These units are made by a process of coating mica, producing a flat surface the entire area of which gives off heat. The units illustrated herewith are a standard radiator unit of 500 watts capacity, a 5-lb. flatiron unit rated 350 watts and a water vessel unit rated 150 watts.

Electrically Driven Automatic Valve Grinder

An electrically driven valve grinder with attachment for grinding a reseating tool has recently been introduced to the automobile trade by the Franklin Machine Tool Company, Springfield, Ohio. There are three units to the machine, the ¼-hp. Westinghouse driving motor, the grindstone and the valve



BOTH VALVE AND GRIND WHEEL TURN

holder, which also has an attachment for holding the reseating tool. The grindstone and valve holder are attached by belt drives to motor and valve lip and stone turn against each other.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE WADSWORTH ELECTRIC COMPANY, Covington, Ky., has just completed its plans for recapitalization from $150,000 to $500,000.

CHARLES F. NORTON has returned to the Howell Electric Motors Company, Howell, Mich., as general manager under the enlarged program of expansion. Mr. Norton was Cleveland manager of the ELECTRICAL WORLD. Mr. Norton was one of the founders of the Howell company, going from that company to the ELECTRICAL WORLD staff in 1919.

GENERAL ELECTRIC COMPANY OFFERS STOCK TO EMPLOYEES.—Under authority conferred by its shareholders at a recent meeting, the General Electric Company offers to its employees the privilege of subscribing for one to ten shares of its capital stock at the price of $136 per share. There will be a credit, amounting to $20 per share, against the subscription price, which will represent a net return substantially the same as that which would be enjoyed by any one purchasing stock on an installment plan, paying interest on deferred installments and receiving cash and stock dividends. Certificates of stock will be issued to the subscribers only when payments, including any other credits, amounting to $116 per share shall have been made. If the number of shares subscribed for shall exceed the number of shares available for subscription, the company reserves the right to reduce any or all subscriptions in excess of one share. Payments will be made by deductions from salary or wages in twenty-nine monthly installments of $4 for each share subscribed for or in 116 weekly installments of $1 for each share subscribed for. A subscriber may withdraw from his subscription agreement any time prior to his decision to make final payment and take his stock certificate. In case of withdrawal the total amount paid by him by deductions from salary or wages, plus interest at the rate of 7 per cent per annum, will be refunded. The same procedure will be followed where a subscriber ceases to be an employee before his payments are completed.

FRANKLIN P. WILDS has severed his connection with the Irvington Varnish & Insulation Company to become vice-president of the Standard Insulator Company, Rutherford, N. J., manufacturers of varnished combric, oiled paper, oiled silk and various kinds of varnished treated tapes. Mr. Wilds was formerly with the Mica Insulator Company, the Linonite Company and the Keene Mica Products Company, and for the past ten years has been with the Irvington Varnish & Insulator Company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has announced that negotiations are being closed for the purchase of the plant and property of the Independent Lamp & Wire Company at Rochester, Pa. Although this plant was formerly used for the manufacture of glassware, the Westinghouse company plans to utilize it for the production of micarta materials of all kinds, as well as repair parts for electrical machinery. This plant has a total floor space of upward of 130,000 sq.ft.

R. H. RICE DENIES WAGE CUT IS PLANNED.—Neither wage cutting nor a general lay-off is considered by the Lynn works of the General Electric Company, declared R. H. Rice, manager of the plant, at a meeting of employees' representatives last week. About 200 were in attendance at a supper, which was followed by a talk on production by J. M. Davis, production manager of the Lynn factory, and Mr. Rice's address on the business outlook. The latter pointed out that business is decreasing, but that a large volume of orders still remains on the company's books. He appealed to the employees to give reasonable service in the delivery of these orders, thus enabling the plant to "carry on" until the tide of business returns. Mr. Rice said that if orders are neglected and deliveries lengthened unduly, orders will be canceled and the good will of customers lost. For months the plant has been working on parts of equipment which cannot be immediately applied to shipments, and the time has come to call a halt on such work. Manager Rice said that while some employees would have to be laid off, the number will be made as small as possible and the time cut as short as possible. He vigorously denied that the plant would be shut down longer than necessary to take the regular November inventory.

HEATER CORD STANDARDS.—Pages for the Underwriters' Laboratories' code for electrical appliances giving the new standard for heater cord were distributed very recently. This standard was recently adopted by the industry-conference for rubber-covered wires and cables and by the laboratories' electrical council, and it supersedes all instructions previously issued on this subject.

J. L. LONG has secured from L. M. Grant and others a controlling interest in the Continental Pipe Manufacturing Company, manufacturer of wooden flumes, Seattle, Wash. Mr. Grant is no longer with the company.

THE PIERCE FUSE CORPORATION OF BUFFALO, N. Y., announces the appointment of Emory M. Coffin as sales manager, succeeding P. S. Klees.

THE KENTUCKY ELECTRIC LAMP COMPANY, Owensboro, Ky., has purchased the license, machinery and good will of the Davis Tungsten Lamp Company, Weehawken, N. J., making possible a great increase in the production of tungsten lamps. The affairs are in charge of Roy Burlew, formerly sales manager of the Novelty Incandescent Lamp Company, and the factory is under the supervision of M. E. Pierson, formerly superintendent of the Novelty company. Joseph Kay, of Emporia, Pa., is president, and A. Brady, of Emporia, is treasurer. The sales offices and factory will continue at Owensboro, Ky.

THE J. B. ENGINEERING SALES COMPANY has been appointed Connecticut sales agent of the Conveyors' Corporation of America, formerly the American Steam Conveyor Corporation. Offices are at 60 Prospect Street, Hartford, Conn. This company is owned by John Breslau, formerly sales engineer, manager of publicity and production manager of the Terry Steam Turbine Company. The J. B. Engineering Sales Company is sales agent for the Griscom Russell Company and the Terry Steam Turbine Company in Connecticut.

THE YOUNGSTOWN SHEET & TUBE COMPANY has just put in operation a plan whereby employees may subscribe for stock, to be paid for in installments, at fifteen points less than the market. The plan further provides for permanency of employment by giving the employee who keeps his stock a bonus of $5 per share for five years after the stock has been paid up.

THE EDISON LAMP WORKS of the General Electric Company announces that permanent installations of the industrial lighting exhibit are being arranged in the larger industrial centers. A series of portable exhibits, plans for which will be announced later, will take care of those sections not reached by the permanent installations.

E. C. STOCKDALE has returned to the Page & Hill Company as general salesmanager, with present headquarters at 19 South LaSalle Street, Chicago. For the past two and a half years he has served in the army in one branch and another and rose to the rank of lieutenant colonel. Colonel Stockdale, prior to entering the pole industry in 1914, was purchasing agent with Stone & Webster in the construction of the plants of the Mississippi River Power Company at Keokuk, Ia., and the Minneapolis General Electric Company. He opened up the Chicago office of the Page & Hill Company Jan. 1, 1914, and remained there in charge until he entered the service in May, 1917.

THE VAN DORN ELECTRIC TOOL COMPANY, Cleveland, Ohio, is marketing in Ohio a new issue of 8 per cent cumulative preferred stock. This company, which makes portable electrically driven tools, was organized in 1913 to take over the toolmaking department of the Van Dorn & Dutton Company. Its sales for the last four years ended June 30 have been: 1917, $445,997; 1918, $714,705; 1919, $1,031,513; 1920, $1,190,815.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY Canadian and American representatives held a meeting recently at Niagara Falls, Ontario, to discuss and draw up 1921 sales plans. Changes in and addition to the Benjamin products were suggested.

NEW METHOD OF PACKING MINIATURE LAMPS EFFECTS ECONOMY IN SPACE AND COST.—Following a great deal of experimental work, the Edison Lamp Works of General Electric Company announce a new method of packing Edison miniature "Mazda" lamps that is said to be a great improvement over the old. The system is similar to the method of packing large tungsten lamps adopted by the company in the recent past. The principal advantages claimed for the new method are a saving of about 40 per cent in weight and 60 per cent in space, the elimination of excelsior, reduction of breakage in handling and greater ease in making up an assortment of miniature lamps. Under the old method of packing there were five lamps to a carton, and each lamp was placed in a "Climax" wrapper and the cartons packed with excelsior in an outer container. The wrapper enabled the lamp to fall out and gave no protection to the end of the bulb. Hence an individual lamp carton was used on each lamp, but these did not give sufficient cushioning effect to prevent breakage. The difficulty was solved by the development of a wrapper consisting of a strip of corrugated paper to which was fastened a piece of smooth paper. The lamp is rolled up in the wrapper and the ends of the smooth paper twisted to hold the lamp in place. The twisted ends incidentally protect the tip of the bulb and the wrapper thus gives reasonable protection from breakage, it is stated. To find a paper tough enough not to tear and yet fine enough to allow printing on it offered some difficulty, but these wrappers are now being made by an automatic machine which turns out 80,000 per day. Tests to determine the efficiency of the new wrappers in preventing breakage have shown excellent results. Handling, which resulted in about 4 per cent breakage with the old-style packing, showed no lamps broken with the new. As an example of the saving in space and weight that is also effected, a representative size with the old excelsior packing weighs 7 lb. and takes up 2,362 cu.in. of space in a 100-lamp box, while the new system of packing for the same lamp and in the same quantity shows a weight of 6 lb. and only 960 cu.in. of space. These factors are expected to mean considerable economies in the cost of shipping and stock space required. The shortage of paper is having its effect on the supply of cartons available, and recently, it is said, rather than hold up orders the company shipped some types of lamps in odd-sized outer boxes.

GENERAL ELECTRIC BILLING AT $267,000,000 RATE.—The General Electric Company's billings for the first nine months of this year amounted to approximately $200,000,000, it is reported. At this rate billings at the end of the year would amount to about $267,000,000, compared with $229,900,000 last year. Total bookings for the nine months were between $255,000,000 and $260,000,000, or at an annual rate of about $345,000,000. Incoming orders have thus been greater than shipments by at least $55,000,000. At the first of the year the company had unfilled orders on its books amounting to $98,880,000.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agent in Serbia (No. 33,965) proposes to organize a trade bureau

for the Balkans and later to open branches in Zagreb, Sofia, Bucharest and Piraeus, and maintain industrial exhibits and a warehouse for the promotion of the sale of American products, including electric motors and accessories.

A commercial representative in Australia No. 33,966) desires to purchase or secure an agency for the sale of electrical household devices. Quotations should be given f. o. b. New York, San Francisco or Vancouver. Payment to be cash against documents on arrival of shipment.

Trade Publications

PUMP CONTROL APPARATUS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued its publication No. 860, covering control apparatus for pumps, compressors and similar service.

ELECTRIC HOISTS.—The Sprague Electric Works of the General Electric Company, 627 West Thirty-fourth Street, New York, has issued bulletin No. 48,961, covering floor-controlled electric hoists.

WELDING AND CUTTING APPARATUS.—The Bastian-Blessing Company, West Austin Avenue, Chicago, has issued catalog No. 20, covering "Rego" welding and cutting apparatus.

STOKERS.—The Illinois Stoker Company, Alton, Ill., has issued an illustrated fifty-page catalog and data book covering Illinois stokers for use with either natural or forced draft.

METERING TRANSFORMERS. — The Packard Electric Company, Warren, Ohio, has issued a sixteen-page illustrated bulletin, No. 208, on "Metering Transformers," describing the weatherproof and switchboard types of the single-phase, two-phase and three-phase potential and current transformers.

WIRE AND CABLE.—The Habirshaw Electric Cable Company, Yonkers, N. Y., has printed a manual of wires and cables giving in readily accessible handbook form information or names, types and description of wires and cables on the manufacture of rubber-covered wire and on the wiring of buildings.

COMMUTATOR STONES.—The Martindale Electric Company, Cleveland, Ohio, has issued a folder which describes and prices its "Handy" natural stones and also the new "Imperial" artificial stones which have just been placed on the market for grinding commutators.

New Incorporations

THE ELECTRIC SUPPLY COMPANY, Mercedes, Tex., has been incorporated with a capital stock of $10,000 to deal in electrical supplies. J. H. Jacobson and others are the incorporators.

THE SAFETY FUSE HANDLE COMPANY, Richmond Hill, N. Y., has been incorporated with a capital stock of $16,000 to manufacture electrical apparatus. G. R. Cohen, S. Green and E. V. Glucke, all of Richmond Hill, are the incorporators.

THE A. J. DEER COMPANY has been incorporated in Delaware by A. J. Deer, L. G. Robbins and C. M. Nevins to manufacture electric coffee mills, roasting machines, etc.

THE JEFFERSON POWER COMPANY of Watertown, N. Y., has been incorporated with a capital of $50,000 by D. M. Anderson, D. C., Middletown and E. B. Martin.

THE HANNITE COMPANY, of Columbus, Ohio, has been chartered with a capital stock of $10,000 to hold patents on and sell the rights to manufacture a new electrical insulator which will go under the name of "Hannite," patents on which are now pending with the Patent Office at Washington. The incorporators are T. L. Hanson, R. G. Martin, D. N. Postlewaite, E. Hauck and H. H. Orr.

THE MIDDLEFIELD ELECTRIC LIGHT COMPANY, Middlefield, Ohio, has been chartered with a capital stock of $10,000 to manufacture and sell electrical energy for lighting and power. The incorporators are J. E. Johnson, H. C. Johnson, Hattie S. Johnson, S. M. Johnson and Viola Johnson.

THE WEST LEBANON ELECTRIC LIGHT & POWER COMPANY of Ohio is a new central-station company which has been incorporated with a capital stock of $35,000 by Drs. George and John Snively, Jacob Minser, Elva E. Budd and Elmer Hofacre.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FRANKLIN, N. H.—The Laconia Gas & Electric Company, Laconia, is considering the development of water power at Profile Falls on the Smith River, north of Hill Village, and bringing electric power to Laconia to supply the need of additional electric energy in Franklin.

FALL RIVER, MASS.—The Fall River Electric Company has voted to petition the Public Utilities Commission for permission to increase its capital stock to $2,850,000 by issuing 7,000 shares at $100 par, the proceeds to be used for new and proposed construction.

Middle Atlantic States

WHITEHALL, N. Y. — The Champlain Silk Mills contemplates the installation of a 300-kw. generator and a 400-hp. waterwheel.

SOUTH ORANGE, N. J.—The Board of Trade has decided to start a movement for the installation of an electric street-lighting system. Raymond Connolly is a member of the civic committee in charge.

RISING SUN, MD. — Citizens of this place have subscribed to $25,000 bonds for a new electric light plant.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of a turbo-generator and switchboard equipment at Bellevue. Also the erection of radio compass buildings at the following places: Cape May, N. J., Cape Hatteras, Cape Lookout, Poyner's Hill, N. C., Hog Island and Virginia Beach, Va.

WASHINGTON, D. C.—Applications for preliminary permits or licenses under the water-power act have been filed with the Federal Power Commission as follows: Alaska Endicott Mining & Milling Company, care of John B. Marshall, Juneau, Alaska; William Park Mills, care of P. S. Brown, 697 Montana Building, Missoula, Mont.; Spirit Lake Railway & Power Company 110 East Twelfth Street, Vancouver, Wash.; Wenatchee Commercial Club, Wenatchee, Wash.; United Mills Company, Hickory, N. C.; Rock Creek Power Company, Missoula, Mont., and H. H. Wadsworth, Holbrook building, San Francisco, Cal.

North Central States

LAKEVIEW, MICH. — A committee of business men of Lakeview has appointed Oliver Edgar, construction engineer, to prepare estimates for a power plant.

CLEVELAND, OHIO.—The Chesterland Light & Power Company, recently incorporated, contemplates furnishing light and power to the residents along Mayfield Road from Scotland to Hunkburg, a distance of about 14 miles. W. W. Davies, National City Building, is in charge.

EAST YOUNGSTOWN, OHIO.—The city officials are considering the submission of an issue of $15,000 in bonds to the voters, for the installation of a police signal and call system. Anthony Julius is clerk.

PIQUA, OHIO.—The County Commissioners have granted a twenty-year franchise for a transmission line through Newberry, Newton and Union to the plant of the Buckeye Power Company, Covington.

CHICAGO, ILL. — Contract will soon be awarded by the Commonwealth Edison Company, 72 West Adams Street, for the erection of a power plant on 100th Street at Commercial Avenue, to develop 200,000 kw., at a cost of about $5,000,000. Marshall & Fox, 721 North Michigan Avenue, are architects.

ALBANY, WIS.—Bids will be received by W. G. Kirchoffer, engineer, 31 Vroman Block, Madison, until Nov. 12, for furnishing and setting one centrifugal pump, with capacity of 160 gal. per minute against a 165-ft. head, motor and controlling apparatus for the water-works plant.

VERONA, WIS.—The Verona Light & Power Company contemplates the purchase of transformers in connection with the transmission line to be erected at a cost of about $15,000. F. M. Conlee, Washington Building, Madison, is engineer.

WEST BEND, WIS.—Plans are under way by the Federal Engineering Company Stephenson Building, Milwaukee, for the erection of a boiler and power house on Main Street for the West Bend Aluminum Company, to cost about $75,000.

HAMILTON, KAN.—Estimates are being prepared by J. H. Johnson, engineer of the state inspection department, for a new light plant at this place.

LIBERAL, KAN.—The City Council will receive bids until Nov. 9 for two centrifugal pumps for 365-ft. head, direct-connected to 75-hp. motors, etc. The cost is estimated at $98,000. Ruckel Engineering Company, Hutchinson, is engineer.

MONTEZUMA, KAN. — Bonds to the amount of $8,000 have been voted for the erection of an electric light plant. The issue of additional bonds to the amount of $15,500 will be submitted to the voters.

Southern States

FORT MYERS, FLA.—Peter Schutt and associates, Bradford Hotel, will receive bids early in December for the erection of a hotel to cost between $400,000 and $500,000. The installation of a small electric plant is under consideration. F. J. Kennard, American Bank Building, Tampa, is architect.

MARTIN, TENN.—Bonds to the amount of $150,000 have been voted for the erection of electric light and water plants.

PASCAGOULA, MISS. — Bonds to the amount of $25,000 have been voted for the installation of electric light and water systems in this city.

Pacific and Mountain States

CHEWELAH, WASH.—An ordinance has been passed granting the Stevens County Power & Light Company, Colville, the authority to erect and maintain all appliances necessary for the transmission of electrical energy to this place.

BAKER, ORE.—The Eastern Oregon Light & Power Company contemplates the extension of its service to the White Swan Mines.

KLAMATH FALLS, ORE.—The California-Oregon Power Company plans to increase the capacity of its Prospect plant on Rouge River from 4,700 kw. to 20,000 kw.

PORTLAND, ORE.—The Portland Railway, Light & Power Company contemplates the construction of a $4,000 temporary substation to take the place of its Northern Hill station, destroyed by fire; a permanent structure to cost about $35,000 will be erected at a later date. Fire at the Cazadero hydro-electric plant also destroyed two generators and other equipment amounting to $6,000.

WALLOWA, ORE. — The Nibley-Minnaygh Lumber Company has applied to the state engineer for permission to divert 300 sec.-ft. of water from the Wallowa River for generating electric power for lighting plant, sawmill, etc. The cost is estimated at about $15,000.

EL CENTRO, CAL.—The plant of the Holton Power Company is to be overhauled and placed in first-class condition.

LOS ANGELES, CAL.—The Los Angeles Railway Corporation, Sixth and Main Streets, contemplates improvements, including the erection of three substations to cost about $500,000 and the renewal of overhead equipment about $300,000. G. J. Kuhrts is general manager.

LOS ANGELES, CAL.—J. Harvey Pierce has applied to the State Railroad Commission for permission to divert 10 sec.-ft. of water from streams in Mono County for the development of 595 hp.

PASADENA, CAL. — The Chamber of Commerce is circulating a petition for the installation of an ornamental street-lighting system along West Central Avenue.

RIVERSIDE, CAL.—The Southern Sierras Power Company contemplates the development of 5,793 hp. in San Bernardino

County, by diversions from several creeks. The cost is estimated at $500,000, including conduit, dam and wasteway.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company contemplates the diversion of water from the west fork of the San Luis Rey River for the development of 775 hp. The cost, including a 3½-mile conduit and dam, is estimated at $235,000.

SONORA, CAL.—Application has been filed with the Recorder of Tulomne County by Frank B. Pattee of Oakdale and Samuel Bernhard of San Francisco for utilization of part of the natural flow of the Stanislaus River for the development of 9,600 hp. Plans include the erection of a power plant and dam. Estimated cost about $2,000,000.

SALT LAKE CITY, UTAH.—The City Commission has instructed the city recorder to advertise for bids for extensions to the ornamental street-lighting system.

DOUGLAS, ARIZ. — City Engineer Bane has estimated $5,200 as cost for the proposed ornamental lighting system on lower G Avenue.

PRESCOTT, ARIZ.—The Prescott Gas & Electric Company contemplates extension to its electric distribution system at a cost of about $34,000. Plans include transformers, meters, etc.

Canada

STAVE FALLS, B. C.—It is reported that the Western Canada Power Company has plans under way for raising the level of the storage dam at this place which will allow for the installation of a 13,000-hp. electrical unit at the company's power house, to cost about $200,000.

CARMAN, MAN.—The ratepayers of this place voted on extending the hydro-electric power line to Carman.

WINNIPEG, MAN.—The Winnipeg Electric Company contemplates an issue of preferred stock for expenditure on the plant and for the completion of certain extensions.

GRAND FALLS, N. B.—The International Paper Company, Three Rivers, Que., contemplates the development of water power at this place.

MONTREAL, QUE.—The Riordan Pulp & Paper Company of Montreal contemplates the development of 250,000 hp. on the Quince River.

Miscellaneous

MORWELL, AUSTRALIA.—Bids will be received by the secretary, Electricity Commissioners, State of Victoria, 673 Bourke Street, Melbourne, Australia, until Feb. 24, 1921, for the erection of a generating and transmission plant at Morwell, to develop an initial capacity of 50,000 kw. and a maximum of 150,000 kw. Plans also include the erection of a 90-mile transmission line from Morwell to Melbourne, consisting, in the first stage, of one line of towers with two three-phase circuits, each having a capacity of 25,000 kw. Electrical installation equipment for Melbourne is listed as follows:

Specification No. 32 — Three 25,000-kw. turbo-alternator sets complete with condensing plant, pumps and all necessary accessories; generators to be wound for 11,000 volt, three-phase, 50-cycle, 1,500 r.p.m. As an alternative 12,500-kw. sets will be considered at 3,000 r.p.m. In the same specification one 600-kw., 400-volt, three-phase, 50-cycle, 3,000 r.p.m. turbo-alternator is called for.

Specification No. 33.—Transformers and switchgear for controlling the above generators and also two high-tension lines. The transformers are to be of the single-phase, water-cooled outdoor type, 9,260 kva., each stepping up the voltage from 11,000 to 132,000, connected delta-star neutral permanently earthed, all the switchgear to be of the outdoor type, and the necessary control panels, conduits, control cable and galvanized steel work as called for in this specification.

Specification No. 34. — Seven hundred miles of 37/14 S. W. G. wire (area 0.182 sq.in.). Or Specification No. 37.—Seven hundred miles of aluminum steel reinforced cable (alternative).

Specification No. 35.—Eight hundred and fifty suspension and one hundred strain towers, normal span, 700 ft. Or Specification No. 38.—Five hundred and fifty suspension and seventy-five strain towers, normal span 1,056 ft. (alternative).

Specification No. 36.—Fifty thousand suspension units to be made up into strings of seven and eight, suitable for 132,000 volts (for copper cable line). Or Specification No. 39.—Forty-five thousand suspension units to be made up into strings of seven and eight (for aluminum cable). (Alternative.)

Specification No. 40.—One hundred and twenty-five miles ½-in. double galvanized steel cable.

Specification No. 41—Complete installation of terminal station in which is included: Two 15,000-kva. synchronous condensers; two banks of 30,000-kva. water-cooled transformers, 120,000 to 22,000 volts, connected delta-star neutral point earthed through a resistance; one 12,000-kw. frequency changer, 22,000 volts, 50-cycle, 20,000 volts, 50-cycle; two banks of 6,000-kva. water-cooled transformers, 22,000 volts to 6,600 volts; necessary 120,000-volt to 22,000-volt, 6,600-volt outdoor type switchgear; also control panels, cables, conduits, control wiring and all steel work.

Specification No. 42.—Complete installation of three substations, in which are included banks of 3,000-kva. and 6,000-kva. transformers, outgoing and incoming overhead and underground feeders. All this equipment will be of the indoor type.

Specification No. 43.—Two thousand steel telephone poles, approximately 35 ft. high, to carry two telephone lines and one 22,000-volt feeder line between Morwell and Melbourne.

Specification No. 44.—Complete installation of telephone apparatus at the power house, terminal station and along the route of the transmission line. At the power station and the terminal station there will be in each a C. B. board, suitable for thirty lines, to be extended at a later date to 100 lines; also all necessary high-tension telephone apparatus suitable for a telephone line operating in the vicinity of the 132,000-volt transmission line.

The total cost of this project is estimated at $15,000,000. A number of bid forms and specifications have been forwarded to the Commercial Intelligence Branch of the Department of Trade and Commerce, Ottawa, Ontario. Copies of the specifications may also be seen at the offices of the Canadian Manufacturers' Association, 42 St. Sacrament, Montreal, and at Traders' Bank Building, Toronto.

Record of Electrical Patents

Notes on United States Patents

(Issued Oct. 26, 1920)

14,966 (reissue). MACHINE FOR MARKING SHOE UPPERS; Arthur W. Brice and Irving E. Booth, Rochester, N. Y. App. filed April 19, 1916.

14,967 (reissue). SYSTEM FOR THE TRANSMISSION OF INTELLIGENCE; Raymond A. Heising, East Orange, N. J. App. filed Oct. 9, 1915.

1,356,546. CIPHERING SYSTEM; Lyman F. Morehouse, Montclair, N. J. App. filed Dec. 4, 1918. Applicable to printing telegraph.

1,356,592. TELEGRAPH SYSTEM; John H. Bell, South Orange, N. J. App. filed Nov. 22, 1917. Duplex.

1,356,598. AUTOMATIC ALARM VALVE; Edmund A. Cahill, Kansas City, Mo. App. filed May 9, 1917. Warns that water valve is open.

1,356,603. TROLLEY-WIRE GUARD; Emard A. Croston and Kamimier Chrobak, Rosemont, W. Va. App. filed June 11, 1920. To safeguard miners.

1,356,611. CUT-OUT PLUG; John W. Egan, Toronto, Ontario, Canada. App. filed Oct. 15, 1919. For toasters, irons, etc.

1,356,617. ELECTRICAL RESISTANCE ELEMENT; Frederick M. Goddard, Brooklyn, N. Y. App. filed March 12, 1920. Crystal type.

1,356,622. SWITCHBOARD; Alexander M. Habrich, Chicago, Ill. App. filed Aug. 13, 1917. Telephone.

1,356,626. SELECTIVE SIGNALING SYSTEM; John A. Hulit, Chicago, Ill. App. filed March 16, 1912. Telephone.

1,356,634. RHEOSTAT FOR TELEPHONIC INSTRUMENTS; Henry Koch, Jamaica, N. Y. App. filed Oct. 20, 1919. For deaf persons.

1,356,639. TELEPHONE-EXCHANGE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Nov. 14, 1916. For ringing.

1,356,643. TELEPHONE SYSTEM; James L. McQuarrie, Montclair, N. J. App. filed Dec. 27, 1918. Ringing.

1,356,654. MEASURED-SERVICE TELEPHONE SYSTEM; William W. Owen, Elgin, Ill. App. filed May 7, 1917. Subscriber's meter.

1,356,655. MEASURED-SERVICE TELEPHONE SYSTEM; William W. Owen, Elgin, Ill. App. filed July 30, 1917. Subscriber's meter.

1,356,686. MEANS AND METHOD FOR SECRET SIGNALING; Harold D. Arnold, East Orange, N. J. App. filed Dec. 30, 1916. By apparently steady light beams.

1,356,701. SECRET TELEGRAPHIC SYSTEM; Augustus J. Eaves, New York, N. Y. App. filed June 24, 1918. Prevents interception.

1,356,704. TELEPHONE-EXCHANGE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Jan. 27, 1919. Manual connected to automatic.

1,356,720. LIGHTNING ARRESTER AND MOUNTING; Ernest H. Jacobs, Chicago, Ill. App. filed June 17, 1918. Gap in line with circuit and choke coil at right angles.

1,356,751. RADIO-SIGNALING APPARATUS; Roy A. Weagant, New York, N. Y. App. filed July 12, 1918. Eliminates static effects.

1,356,752. RADIO-SIGNALING APPARATUS; Roy A. Weagant, New York, N. Y. App. filed July 12, 1918. Static disturbances balanced out.

1,356,753. STORAGE-BATTERY-CHARGING SYSTEM; Edward F. Andrews, Chicago, Ill. App. filed Jan. 8, 1917. Prevents overcharge.

1,356,763. OSCILLATION GENERATOR; Ralph V. L. Hartley, New York, N. Y. App. filed June 1, 1915. Radio.

1,356,767. APPARATUS FOR AND METHOD OF TRANSMITTING PHOTOGRAPHS AND OTHER PICTURES TELEGRAPHICALLY; James E. Homans, New York, N. Y. App. filed June 4, 1915. Over ordinary service lines.

1,356,818. HEATING APPARATUS; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed July 11, 1917. For heating vapor.

1,356,846. HUMIDIFIER; Daniel H. Young, Manchester, Iowa. App. filed Feb. 10, 1919. Electrical heating.

1,356,881. ELECTRIC HOT-WATER HEATER; Richard P. Osgood, Windsor, Vt. App. filed June 24, 1920.

1,356,933. INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Multispeed.

1,356,934. MULTISPEED INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Simplified connections.

1,356,935. MULTISPEED INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Simple connections.

1,356,936. INDUCTION MOTOR; Campbell MacMillan, Schenectady, N. Y. App. filed May 31, 1917. Means for increasing torque.

1,356,965. ELECTROTHERMAL BLANKET, Phyllis E. Charles, Victorville, Cal. App. filed June 15, 1918. Surgical.

1,356,975. MAGNETO; René G. L. Dusuzeau, Billancourt, France. App. filed April 24 1917. Rotating inductor.

1,356,977. ELECTRIC CELL; Charles Fery, Paris, France. App. filed Feb. 19, 1918. No local action.

1,357,008. MAGNETO; John R. Stark, Racine, Wis. App. filed Dec. 8, 1917. Movable inductor.

1,357,016. COMMUTATOR CONNECTOR; Thomas Zimmerman, Cleveland, Ohio. App. filed Nov. 12, 1915. Connects leads to bars.

1,357,019. ELECTRICALLY HEATED WATER SERVICE AND SYSTEM; George Alexander Northcote, and James J. Rafferty, Hawthorn, Victoria, Australia. App. filed Sept. 26, 1918. Hot water at short notice.

1,357,080. BRAZING MACHINE; Robert J. Peck, Key West, Fla. App. filed March 26, 1920. To braze ends of strips of metal.

1,357,126. ELECTRIC CELL FOR MINERS LAMPS AND FOR SIMILAR PURPOSES; Theodore Stretton, Cardiff, Wales. App. filed Aug. 11, 1919.

1,357,142. RECTIFIER; George N. Blanchard, San Francisco, Cal. App. filed July 28, 1919. Employs interrupted jet of mercury.

1,357,156. METHOD OF WELDING CHAIN LINKS; Claes W. Harry von Eckermann, Ljusne, Sweden. App. filed March 17, 1920. No slag in [illegible]

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 10, 1921.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, Bethlehem, Pa.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. Thirty-ninth Street, New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio. Annual meeting, Chicago, Dec. 28-Jan. 1.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York City.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 Fifth Avenue, New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill. Annual meeting, Hot Springs, Va., Nov. 15-17.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria Street, Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex. Annual meeting, St. Louis, Nov. 25 and 26.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

MICHIGAN SECTION, N. E. L. A. Secretary, Herbert Silvester, Ann Arbor, Mich.

MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis, Minn.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 Fifth Ave., New York City.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga. Annual convention, Miami, Fla., Nov. 17-19.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual convention, Detroit, Mich., Jan. 25-27, 1921.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Bldg., Milwaukee, Wis.